THE LEVEL OF MENTAL IMAGERY USE BY INJURED COLLEGIATE ATHLETES DURING REHABILITATION

A THESIS

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INTRODUCTION

The mind and body are physically connected however in some cases they are viewed as separate entities. "Mind over matter" is a statement often used to get through tough situations (Morgan, 1984). Mental imagery is a technique used to focus the mind on a particular task or event (Cox, 2001). Mental imagery is defined as using all the senses to create or re-create an experience in the mind without the external stimuli (Cox, 2001). The image is created using information stored in the information register, working memory, or long term memory (Cox, 2001). According to Cox (2001) mental imagery has many uses in athletics. Athletes can use mental imagery to practice skills, to cope with stressful situation, and for pain management.

The sub-categories of imagery are motivational imagery, cognitive imagery, and healing imagery Motivational imagery is the use of mental imagery to experience goal attainment, effective coping, and/or arousal management. Cognitive imagery is the use of mental imagery to experience specific sports skills and to plan strategies before during and after competition (Cox, 2001).

Healing imagery is the use of mental imagery to visualize the healing process (i.e. tendons reconnecting to bones).

Psychological antecedents and emotional reactions play a key role in athletic injury rehabilitation. Herring, Boyahian-O'Neill, Coppel, Daniels, Gould, Grana et al. (2002) reported that the use of psychological strategies such as goal setting, positive self-talk, cognitive restructuring and imagery techniques are associated with faster recovery. Thus these strategies could have an effect in reducing the length of rehabilitation and shortening the time that an athlete is not participating in his/her sport.

Athletic Trainer

Athletic trainers are allied health care professionals recognized by the American Medical Association, who collaborate with physicians to optimize activity and participation of physically active patients and clients. The typical athletic training setting includes: professional sports, collegiate athletic, high school athletics, sports medicine clinics, as well as health/ fitness clinics. Athletic training encompasses the prevention, diagnosis, and intervention of emergency, acute, and chronic medical conditions of athletic injuries.

These conditions may include physical impairments, functional limitations, and disabilities (National Athletic Trainers' Association [NATA], 2009).

Athletic trainers typically spend extended periods of time with athletes under conditions that promote personal interactions and trust (Moultan, Molstad, & Turner, 1997). Each of the six domains of the athletic training profession has psychological competencies associated with them.

The domains of athletic training are: (1) the prevention of athletic injury and conditions, (2) clinical evaluation and diagnosis of athletic injury conditions, (3) the immediate care of athletic injuries and conditions, (4) treatment rehabilitation and recognition of athletic conditions, (5) organization and administrative duties, and (6) professional responsibilities for the profession (NATA, 2009).

The Competencies provide educational program personnel with the knowledge and skills to be mastered by students in an entry-level athletic training educational program. The competencies include recognizing the psychological signs and symptoms of athletic injury, practicing effective communication skills in the areas of health maintenance, and provide athletes with injury prevention education in relation to athletic injury. It is the ethical duty of

athletic trainers to recognize problems within the realm of our training and competencies and refer those that are not.

Collegiate Athletes

The college student athlete can present to the athletic trainers, sport psychologist, educators, sports counselors, and other helping professionals with the same developmental issues non-athletes face (Fletcher, Benshoff, & Richburg, 2003). These issues may include the cognitive, social, moral, educational and psychosocial development of the student athlete during their collegiate years (Fletcher et al., 2003). Furthermore, the college student athlete is also developing their independence and establishing their sense of self. Fletcher et al., (2003) stated that an athlete's success on the field was linked to their overall development and emotional well-being. If an athlete is unsuccessful on the playing field, he/she may become less motivated to continue going to practice.

Based on the literature, college students face a great deal of stress in their daily life as students (Fletcher et al., 2003). College is the setting where students make an attempt to establish themselves as an individual separate from their parents (Fletcher et al., 2003). College student athletes, on the other hand, deal with the stress

of effectively balancing their role of being a student, an athlete, and developing their sense of self (Tinsley, 2005). Identity foreclosure happens when an athlete relates his/her identity as a person to their identity in athletics. Murphy, Petitpas, and Brewer (1996) stated that the belief that a narrow focus on sport is necessary for competitive success may be held by student athletes and strongly reinforced by coaches. As a result coaches and administrator may become less likely to support external activities that may distract their athletes from their sport (Murphy et al., 1996).

Athletes at all level face the fear of losing their playing status (Petrie, 1993). Some players are able to handle this pressure while others are not able to. The athletes' playing status is the role he/she is has on the team. Their role could be starter, second string, relief pitcher etc. There are multiple ways an athlete can alter his/her playing status. Injury, poor performance, and retirement are a couple instances where the athlete's playing status may be altered. Developing a sound set of coping skills can help athletes deal with the pressure of balancing their multiple roles. These roles include consistently performing at a high level in their sport and academic career, as well as developing their sense of self.

Mental Imagery

Mental imagery is one technique adopted by athletes to manage fear as well as improve performance and self-confidence (Chase, Magyar, & Drake, 2005). These techniques are often implemented by athletic trainers, sport psychologists, as well as counselors. Mental imagery can also be used to help with pain management and pain tolerance. The client could use mental imagery skills decrease anxiety associated with the injury which could decrease their perception of pain.

Chase, Magyar, and Drake (2005) study, which focused on fear of injury and self efficacy, interviewed 10 gymnasts ages 12-17. All participants in the study were from the Midwest and competed at level 7-10. These subjects had a training age of approx 8.7 years. In this study the gymnasts were asked questions about the types of injuries in gymnastics, reasons they participate, their fear of injury, sources of self efficacy (self-confidence) and mental/physical strategies used to overcome fear of injury.

A person's self efficacy may help them overcome the fear of injury. According to Bandura (1997) self efficacy is a person's beliefs in his or her own capabilities. There are four factors known to affect ones self-efficacy:

performance accomplishments, vicarious experience, verbal persuasion, and physiological arousal. In order to conquer the fear of injury, athletes must learn skills in order to manage the fear.

One function of mental imagery in athletics is pain management. Law, Driediger, Hall & Farwell (2006) used the Athletic Injury Imagery Questionaire-2 in conjunction with the Visual Analogue Scale (VAS) for pain and the Lower Extremity Functional Scale (LEFS) to examine the relationship between the athletes' imagery use and their perceived pain levels. The VAS for pain is a ranking system that allows the client to give a visual representation of their pain level. A typical item in a VAS is a line with marked with the values zero through ten. The client places a mark on the line that represents his/her current pain level. The LEFS is a series of tests used the check client's ability to perform certain movements with the leg. These questionnaires were used to determine whether athletes who used imagery for pain management employed more cognitive, motivational, and healing imagery than the athletes did not (Law et al., 2006).

Law et al. (2006) further states that athletes who employed imagery to alleviate pain were more satisfied with

their rehabilitation than athletes who did not use imagery to manage pain. Athletes often experience pain during different phases of the rehabilitation program. The purpose of the early phase of rehabilitation is it to control pain and the other initial signs of inflammation (Prentice, 2005).

Moreover, Law et al. (2006) report that mental imagery should be used by injured athletes to manage pain; however these results do not translate to improved functionality or changes in the athletes' degree of pain. Law et al. (2006) does emphasize that imagery during rehabilitation did increase the athletes' satisfaction with the rehabilitation program.

Another important use for mental imagery is pain tolerance. Syrjala, Donaldson, Davis, Kippes, & Carr (1995) used 94 patients that have been diagnosed with cancer. Each of the participants recently had or were preparing for their first bone marrow transplantation (BMT). The purpose of this study was to test the oral pain level among the following intervention groups. The interventions associated with the Syrjala et al., (1995) study are treatment as usual (TAU), therapist support (TS), relaxation and imagery(R&I), and cognitive behavior skills training (CB).

The Syrjala et al. (1995) study reported that both the cognitive behavior training (p=.0071) and the relaxation and imagery groups (p=.0088) experienced a reduced pain level from their BMT. An analysis of the patients' perceptions of the helpfulness of the treatments for coping with the symptoms confirmed by decrease in pain and nausea levels.

Problem Statement

The literature base of psychological factors associated with injury is vast; however, there are few studies that examine the correlation between the use of these psychological interventions and the length of time the athletes are enrolled in a rehabilitation program. The psychological response to injury can lead to further injury or an extended rehabilitation. The mental imagery techniques discussed in this study can be implemented to help athletes deal with the stressors associated with injury and injury rehabilitation. There is limited literature that examines correlation between the length of rehabilitation and use of psychological interventions is limited. This study will serve the purpose of expanding the available literature on psychological skills and their functions as they relate to athletic training.

Research Questions

This study will attempt to answer the following questions: 1) does severity of injury correlate to the increased use of mental imagery use during injury rehabilitation? 2) Does length of rehabilitation correlate to the increase use of imagery used during athletic injury rehabilitation?

Research Hypotheses

The following hypotheses were based on previous research and the researcher's intuition based on the review of literature.

1. Athletes with a higher rating for severity of injury will have a higher score for Cognitive Imagery.
2. Athletes with a higher rating for severity of injury will have a higher score for Healing Imagery.
3. Athletes with a higher rating for severity of injury will have a higher score for Motivational Imagery.
4. Athletes with a shorter Rehabilitation of injury will have a higher score for Cognitive Imagery.
5. Athletes with a shorter Rehabilitation of injury will have a higher score for Healing Imagery.
6. Athletes with a shorter Rehabilitation of injury will have a higher score for Motivational Imagery.

METHODS

The purpose of this study was to examine the level of mental imagery use by injured athletes during rehabilitation. This section includes the Research Design, Subjects, Instruments, Procedures, Hypothesis, and Data Analysis.

Research Design

This research is a descriptive study. The first set of variables is severity of injury and length of rehabilitation in weeks. The second set of variables includes the motivational, cognitive, and the Healing imagery scores. There was a test for correlation between severity of injury and all the imagery scores. Additionally length of rehabilitation and all three imagery types was correlated.

Subjects

The participants of this study were California University of Pennsylvania (CALU) student athletes currently going through rehabilitation for injuries. Participation was strictly voluntary.

Instruments

Athletic Injury Imagery Questionnaire-2 is comprised of 12 items concerned with the injured athlete's current use of imagery. Items are representative of the three functions of imagery: motivational imagery (MI), cognitive imagery (CI), and healing imagery (HI). Items 3, 5, 9, and 12 are Motivational Imagery items; items 2, 6, 7 and 10 Cognitive Imagery items; and items 1, 4, 8 and 11 are Healing Imagery items. According to Sordoni, Hall, and Forwell (2002), the creators if the AIIQ-2, the reliability coefficient for the three subsections motivational= .82, cognitive=.84, and healing=.91. (Sordoni et al., 2002)

The American Sports Data Sports Injury Report (2006) has released levels of injury. Level 1 Injury did not interfere with subsequent participation. Level II- Injury prevented participation on at least one or more future occasions, but for less than a month. Level III- Injury prevented participation for at least a month. Level IV- Injury prevented participation for at least a month and resulted in emergency room treatment, overnight hospital stay, surgery and/or ongoing physical therapy. The demographic sheet will have a section that will allow the participant to select their injury severity (Lauer, 2006).

Procedures

After attaining approval from the Institutional Review Board participants were selected based on their injury status at California University of Pennsylvania. Permission to use CALU athletes was received from the CALU Athletic Director.

The CALU Athletic Training Staff was contacted by the researcher via email to determine the status of their athletic teams and if they had athletes were enrolled in rehabilitation program. If they had eligible athletes, the athletic trainer was contacted a second time in order to establish a time that the researcher could meet with the athletes. The CALU athletic training staff sent a follow up email to the researcher to identify the potential subjects that are under their care. Both in season and out of season athletes were included in the study.

The questionnaire packet given to participants consisted of an informed consent document, a demographic sheet that had the athletes' sport, years of participation, injury, severity of injury, and length of rehabilitation. The last page of the packet is the AIIQ-2 questionnaire. There is a copy of the questionnaire packet Appendix C.

As an incentive, two subway gift cards were raffled off after all data was collected. The participants were

issued a raffle ticket upon completing the survey. The raffle ticket stub had the participants email address. The winners were contacted via email. This process was completed separate from the data collection to ensure that confidentiality was not breached.

Research Questions

1. Does severity of injury correlate to the increased use of mental imagery use during injury rehabilitation?
2. Does length of rehabilitation correlate the increase use of imagery used during athletic injury rehabilitation?

Hypotheses

The following hypotheses were based on previous research and the researcher's intuition based on the review of literature.

1. Athletes with higher rating for severity of injury will have a higher score for Cognitive Imagery.
2. Athletes with higher rating for severity of injury will have a higher score for Healing Imagery.
3. Athletes with higher rating for severity of injury will have a higher score for Motivational Imagery.
4. Athletes with shorter Rehabilitation of injury will have a higher score for Cognitive Imagery.
5. Athletes with shorter Rehabilitation of injury will have a higher score for Healing Imagery.

6. Athletes with shorter Rehabilitation of injury will have a higher score for Motivational Imagery.

Data Analysis

SPSS 16.0 was used to test analyzed use for a Pearson Correlation. The correlation between severity of injury and the three types of imagery (Cognitive, Healing, & Motivation) was tested. The correlation between length of rehabilitation and the three types of imagery (Cognitive, healing and Motivational) were tested.

RESULTS

Demographic Data

A sample of the injured athletic population was surveyed resulting in the following data. This sample represents 11 California University of Pennsylvania (CALU) sport teams (See Table 1). Forty-one surveys were administered, and forty were returned. The sample represented both in season and out of season sports. The average years of participation at CALU were 2.1(SD=1.08). The average length of rehabilitation reported by the athletes was 15.3(SD=20.90) weeks. All information received was self-reported.

Table 1 represents the sports that the participants were enrolled in. Twenty-five percent of the participants were softball players and a combined Thirty percent were baseball and softball players. Rugby, Dance, and Ice hockey only had one participant from each of those teams.

Table 1. Frequency table by Sport

Sport	Number	Percent
Softball	10	25.0
Baseball	6	15.0
Track & Field	6	15.0
Football	4	10.0
Volleyball	4	10.0
M. Soccer	3	7.5
W. Soccer	3	7.5
Basketball	1	2.5
Dance	1	2.5
Ice hockey	1	2.5
Rugby	1	2.5

Table 2 represents the self-reported injury from the athletes. Shoulder capsular tightness (4), sprained ankle (4), and torn labrum were at the top of the frequency table. Strained quadriceps (1), strained tibialis anterior (1), and vertebral disc dislocation (1) were at the bottom of the frequency table.

Table 2. Frequency table by reported injury

Reported Injury	Number	Percent
Shoulder Capsular Tightness	4	10.0
Sprained Ankle	4	10.0
Torn Labrum	3	7.5
Hand Injury	2	5.0
Low Back Pain	2	5.0
Pulled Hamstring	2	5.0
Shin Splints	2	5.0
Shoulder Impingement	2	5.0
Shoulder Strain	2	5.0
Back Pain	1	2.5
Biceps Tendon Rupture	1	2.5
Chondromalasia Patella	1	2.5
Elbow Pain	1	2.5
Herniated Vertebral Disc	1	2.5
Knee Capsulitis	1	2.5
Lateral Petalla Dislocation	1	2.5
Plantar Fasciitis	1	2.5
Shoulder pain	1	2.5
SLAP Lesion	1	2.5
Spondy	1	2.5
Sprained ACL	1	2.5
Sprained PCL	1	2.5
Strained IT Band	1	2.5
Strained Quadriceps	1	2.5
Strained Tibialis Anterior	1	2.5
Vertebral Disc Dislocation	1	2.5

Table 3 represents the reported severity on injury based on the American Sport Data Sports Injury Report. Level 1 represented an injury that did not interfere with subsequent performance. Level 2 represented an injury that prevented participation on at least one or more future occasions, but did for lest that a month. Level 3 represented an injury that prevented participation for at least a month. Level 4 represented an injury that prevented participation for at least a month and resulted in an emergency room visit, overnight hospital stay, surgery and/or ongoing physical therapy.

Table 3. Frequency table of reported Severity of Injury

Level	Frequency	Percent
Level 1	14	35.8
Level 2	13	33.3
Level 3	4	10.2
Level 4	8	20.5

Table 4 represents the frequency of the athletes that have received formal mental imagery training. Formal mental imagery was defined in this study as any interaction between a sport medicine professional (i.e. athletic trainers, sport psychologist, sport therapist, physical therapist, or sports counselor) with the purpose of teaching skills that the athlete can use to cope with psychological issues associated with injury and injury rehabilitation. This definition was not shared with the

subjects prior to administering the instrument (see recommendations for future research).

Table 4. Frequency table for Formal Mental Imagery Training

Response	Frequency	Percent
Yes	4	10
No	36	90

Table 5 represents the mean and standard deviation of each item of the questionnaire. The twelve items on the AIIQ-2 were divided in to three sub-categories. Motivational imagery was represented by items 3, 5, 9, & 12. Cognitive imagery was represented by items 2, 6, 7, & 10. Healing imagery was represented by items 1, 4, 8, & 11. The AIIQ-2 is located in APPENDIX C2.

Table 5. Mean and Standard Deviation of each item on the AIIQ-2

Motivational	**Mean**	**Std Dev**
3	5.8	2.59
5	7.1	1.68
9	7.4	2.32
12	5.9	2.73
Cognitive	Mean	Std Dev
2	6.5	2.30
6	5.1	2.73
7	5.3	2.69
10	5.7	2.70
Healing	Mean	Std Dev
1	5.2	3.07
4	5.5	2.84
8	5.6	2.78
11	4.7	2.85

Hypothesis Testing

The section includes the descriptive statistics, Pearson correlation, hypothesis testing, and the additional results.

Table 6 represents the descriptive statistics of the reported items on in the questionnaire packet. The mean for severity of injury was 2.5 SD=1.15. The mean length of rehabilitation was 15.35 SD = 20.92. The mean for cognitive imagery was 22.55 with SD=8.15. The mean for motivation imagery was 26.32 SD 7.64. The mean for healing imagery was 20.55 SD=9.29 (See table 6).

Table 6. Descriptive Statistics

	Mean	Std Deviation	N
Severity of Injury	2.15	1.12	40
Length of Rehab	15.35	20.92	40
Cognitive Imagery	22.55	8.15	40
Motivational Imagery	26.32	7.64	40
Healing Imagery	20.55	9.29	40

Table 7 represents the Pearson correlations and their significance level for all variables. The table also represents all the hypotheses testing.

Table 7. Pearson Correlation

		Severity	Rehab	MI	CI	HI
Severity	Pearson Correlation	1.000				
	Sig. (2-tailed)					
Rehab	Pearson Correlation	0.133	1.000			
	Sig. (2-tailed)	.413				
MI	Pearson Correlation	.156	-.085	1.000		
	Sig. (2-tailed)	.338	.602			
CI	Pearson Correlation	-.215	-.014	.714*	1.000	
	Sig. (2-tailed)	.182	.933	.000		
HI	Pearson Correlation	-.225	-.081	.655*	.631*	1.000
	Sig. (2-tailed)	.165	.618	.000	.000	

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

Hypothesis One: Athletes with higher rating for severity of injury will have a higher score for Cognitive Imagery.

A Pearson correlation coefficient was calculated examining the relationship between participants' severity of injury and cognitive imagery sub-score. A weak

correlation that was not significant was found (r (38) = .215, p> .05). This indicates that severity of injury was not related to cognitive imagery score (see table 7).

Hypothesis Two: Athletes with higher rating for severity of injury will have a higher score for Healing Imagery.

A Pearson correlation coefficient was calculated examining the relationship between participants' severity of injury and healing imagery sub-score. A weak correlation that was not significant was found (r (38) = .225, p> .05). This indicates that severity of injury was not related to healing imagery score (see Table 7).

Hypothesis Three: Athletes with higher rating for severity of injury will have a higher score for Motivational Imagery.

A Pearson correlation coefficient was calculated examining the relationship between participants' severity of injury and cognitive imagery sub-score. A weak correlation that was not significant was found (r (38) = .159, p> .05). This indicates that severity of injury was not related to motivational imagery score (see Table 7).

Hypothesis Four: Athletes with shorter Rehabilitation of injury will have a higher score for Cognitive Imagery.

A Pearson correlation coefficient was calculated examining the relationship between participants' length of rehabilitation and cognitive imagery sub-score. A weak correlation that was not significant was found ($r(38) = .014$, $p > .05$). This indicates that length of rehabilitation is not related to cognitive imagery score (see Table 7).

Hypothesis Five: Athletes with shorter Rehabilitation of injury will have a higher score for Healing Imagery.

A Pearson correlation coefficient was calculated examining the relationship between participants' length of rehabilitation and healing imagery sub-score. A weak correlation that was not significant was found ($r(38) = .081$, $p > .05$). This indicates that length of rehabilitation is not related to healing imagery score (see Table 7).

Hypothesis Six: Athletes with shorter Rehabilitation of injury will have a higher score for Motivational Imagery.

A Pearson correlation coefficient was calculated examining the relationship between participants' length of

rehabilitation and motivational imagery sub-score. A weak correlation that was not significant was found ($r(38) = .085$, $p > .05$). This indicates that length of rehabilitation is not related to motivational imagery score (see Table 7).

Additional Findings

While testing the hypotheses it was found that the there was the significant correlation between the use of motivational imagery and the use of cognitive imagery and healing image.

A Person correlation coefficient was calculated examining the relationship between motivational imagery and cognitive imagery. A strong significant correlation was found ($r(38) = .714$, $p < .01$)

A Person correlation coefficient was calculated examining the relationship between motivational imagery and healing imagery. A strong significant correlation was found ($r(38) = .655$, $p < .01$)

A Person correlation coefficient was calculated examining the relationship between cognitive imagery and healing imagery. A strong significant correlation was found ($r(38) = .631$, $p < .01$)

Additionally a weak correlation was found between the use reported injury severity and the reported length of rehabilitation. A Pearson correlation coefficient was calculated examining the relationship between severity of injury and the length of rehabilitation. A weak correlation that was not significant was found ($r(38) = .133$, $p > .05$)

DISCUSSION

The purpose of this study was to determine if there was a relationship amongst the severity of an athletic injury, length of its rehabilitation, and the use of the three sub-categories of mental imagery. The first purpose of this study was to examine length of rehabilitation as it relates to the use of mental imagery. The second purpose was to examine the severity of an injury as it relates to the use of mental imagery. This section will include the discussion of results, recommendations, and conclusion.

Discussion of Results

The researcher's first set of hypotheses stated that a higher rating the severity of their injury would relate to a higher score for motivational, cognitive, and healing imagery respectively. There was a weak correlation between the severity of injury and the use of cognitive, motivational, and healing imagery. The results of this study though not significant did not reflect the literature on the effectiveness of mental imagery use during rehabilitation. Hamson-Utley and Vazquez (2008) suggested that mental imagery can be implemented with injured athletes during rehabilitation: to promote healing, to

control stress, and to promote and maintain positive mind set. The findings of the Hamson-Utley and Vazquez study can be used as evidence to show that there are benefits of mental imagery.

Ievleva and Orlick (1991) found that fast-healing athletes used more goal setting, positive self, and healing imagery that than slow-healing athletes. These three aspects of the Ievleva and Orlick study are valuable tools for athletic trainers. A possible reason for the results that were not significant is this study is the concept of socially desirable responding. Athletes may change the information that they record because they want to be viewed in a certain way. Athletes may not want to be seen as injured: and therefore may not have been honest about the severity of their injury. Athletes may not want be honest about the severity of their injury, because it poses a threat to their playing status and self concept.

In the second set of hypotheses, the researcher believed that longer rehabilitation would relate to a lower reported use of motivational, cognitive, and healing imagery. There was a weak correlation between the length of rehabilitation and the use of motivation, cognitive, and healing imagery. The findings of this study, though not significant, appear to contradict those found in previous

studies on effectiveness of mental imagery use. Driediger et al. (2006) reported that athletes undergoing rehabilitation described using imagery before or during their rehabilitation session as opposed to after.

Sordoni, Hall, and Forwell (2002) completed a very similar study that used participants with ages ranging from 18-65. The purpose of the current study differs from the Sordoni et al. (2002) study in that it is not including self-efficacy as it relates to mental imagery. Instead, the current study focuses on the length of rehabilitation and the severity of the injury.

Additional Findings

While testing the hypotheses it was found there was a significant correlation between the uses all three types of mental imagery (see Table 7). The athletes in this study that used motivational imagery were more likely to use cognitive and healing imagery as well, which is evidenced by the significant correlation between the three imagery sub-scores. These findings support the internal consistency of the Athletic Imagery Injury Questionnaire-2.

Ten percent of the population (n=4) of the athletes reported they had formal training in mental imagery (see Table 4). Whether or not the other ninety percent (n=36)

of the athletes have had some type of instruction on the use of mental imagery and were unaware of what they were being taught is unclear.

Hypothetico-deductive reasoning may also provide an explanation of why there is a significant correlation between the three sub-categories of mental imagery. This concept is an athlete's ability to use abstract thought to work through multiple variables in order to predict an outcome (Cook & Cook, 2005). In this particular study, athletes know that they need to heal before they can return to participation. An athlete can use hypothetico-deductive reasoning to plan and understand the importance of motivating themselves to complete their rehabilitation as well as correctly performing each exercise that is assigned.

An unexpected finding was that there was a weak correlation that was not significant between the length of rehabilitation and the reported injury severity. The assumption could be that a more severe injury would require a more lengthy rehabilitation program. However the results do not support this assumption.

Recommendations for Future Research

This study did not find any significant correlations; between the length of rehab, injury severity or mental imagery use, however, the information that was found points toward several recommendations for future research. The following section is divided into 1) recommendation for the current study, 2) recommendations for future studies, and 3) recommendations for the athletic training profession.

The results of this study indicate the need for the following modifications: a) a clearly defined definition of the formal mental imagery training for the subjects, b) compare the athlete's self report of their injury with their athletic trainers' assessments, c) find a more refined method of measuring severity, d) include athletes that are not enrolled in rehabilitation, and e) expand study to involve other collegiate institution and high schools.

Formal mental imagery training was one of the items on the demographic sheet. Participants should have a clear understanding of the researcher's definition of formal mental imagery training in order to answer this item. The researcher could also inquire about mental imagery training the athletes may or may not have received prior to this study.

A second modification to this study would be to compare the athletes' self report of their injury with the assessment of the athletic trainers. This will give the researcher an accurate picture of participants' injuries. If the athletes injury information is correct then the severity of their injury would be could be predicted by the injury itself. The next adjustment relates to this injury information reported by the athlete

A refined method of measuring injury severity may give the athletes more categories to choose from. This measurement would assist the researcher in gaining a more accurate picture of the severity of injury, which may correlate more closely with the in data received for the length of rehabilitation.

Another modification to this study would be to increase the number of participants, since have a small population (n=40) limits the ability to generalize the results of the study. One way to do this would be to include athlete that are not currently enrolled in rehabilitation, but have sustained injury. Including athletes from other collegiate institutions and high schools would also broaden the spectrum of the study, increasing the data pool on when athletes are prone to use mental imagery.

Recommendations for future studies include: a) implementing a mental imagery training protocol for the participating athletes and b) implementing a method to limit socially desirable responding.

A mental imagery training protocol would ensure the correct use of mental imagery. This addition would require a between groups design with one group trained in mental imagery and a second baseline group without training.

A second recommendation for future studies is to limit the effect socially desirable responding may have on the study. This could be done by emphasizing that the scope of the study is to measure accuracy rather than a specific result. Additionally the athletes should be assured that their responses will in no way affect their playing status, will be completely confidential, and will only be used for the informational purposes in this particular study

Professional Training Implications

The following are recommendations for the athletic training profession: a) standardize and increase the training in mental imagery for athletic trainers, b) determine the athletic trainers' knowledge, attitudes and behaviors when handling psychological issues, c) implement

a sport psychology certificate program for athletic training students.

Athletic trainers should increase their awareness of the psychological aspects of sport injury and increase their overall knowledge of the functions of mental imagery. Athletic trainers who are already practicing can enroll in mental imagery training courses that offer continuing education units (CEU's) to build their knowledge base. CEUs can be attained in the form of course work or workshops. Currently Athletic trainers are required to accumulate 75 CEUs over a 3 year period of time period. The CEUs are logged and verified with the Athletic Training Board of Certification.

Practice is the only way to develop the techniques used to teach mental imagery to athletes. However, athletic trainers will not practice a skill they do not feel is valuable to this profession. Future studies should determine the athletic trainer's knowledge, attitudes and behaviors when handling the psychological issues, as well as their knowledge and opinions of the use of mental imagery techniques.

Another way for athletic trainers to receive training is to implement a sport psychology certificate program for both undergraduate students and graduate level athletic

training. A sport psychology program for athletic trainers would strengthen the relationship between sport psychologists and athletic trainers.

Clinical Implications

Although this study's results were not found to be significant, there is a considerable body of literature that supports the use of mental imagery to enhance a rehabilitation program. It is important for all sports medicine professional such as sports psychologists, sports therapists, sport counselors, athletic trainers to have an understanding of the psychological and developmental issues faced by the athlete population and how to assist them with these issues. These issues could decrease the athlete's rate of healing, however athletic trainers can teach goal setting, self-talk, mental practice, and healing imagery skills to assist the athlete. Athletic trainers are often the first to notice problems, and with the proper knowledge can inform the athlete about available resources and teach techniques beneficial to student-athletes for use in their sport as well as their life outside of athletics. Athletic trainers should schedule time when they can formally teach athletes the various mental imagery skills. The extended periods of time that athletes tend to be with athletic

trainers are good opportunities for this formal training to occur.

Goal setting is one psychological skill that appeared in multiple areas of the literature. Athletic trainers can use work with the athletic trainer to set both long and short term goals that help the athlete stay on track with their rehabilitation.

Conclusion

There are many possible reasons why the severity of injury and length of rehabilitation program were not significantly correlated to the use of the three mental imagery sub-categories. One reason is that the reported severity of injury may have in some way been skewed by the concept of socially desirable responding. In the literature fear of the loss of playing status is a common fear shared by athletes across the board. By responding in a socially desirable manner the participant can underrate their injury to make it look less severe in order to continue with their current playing status.

The assumption, when comparing length of rehabilitation with the severity of an injury, is that severity would in fact determine the length of

rehabilitation. The correlative was not significant in this particular study (see table 7). An explanation could be that the level 4 severity injuries that were reported to be the most severe experienced short rehabilitation programs. Severe injuries that require surgical repair tend to not require as lengthy of rehabilitation as nagging injuries that last an entire season.

Again, the purpose of this study was look for a correlation between mental imagery and the self reported length of rehabilitation and severity of injury. The results of the hypothesis testing showed that there was not a significant correlation between mental imagery and severity of injury or length of rehabilitation.

In the literature there are multiple examples of how athletes can benefit from the use of mental imagery. As athletic trainers we should improve our knowledge of mental imagery and seek out ways to implement these skills into our daily treatments and rehabilitation programs.

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APPENDICES

APENDIX A

Review of Literature

REVIEW OF LITURATURE

Introduction

College students deal with a range of psychological issues including stress, anxiety and in some cases depression. College student athletes deal with these issues as well as pressure from coaches, parents, and their own internal driving force. Psychological issues have been related to physical injury; therefore we must identify effective coping techniques. Injured athletes work with athletic trainers on a daily basis to rehabilitate injuries. The purpose of this literature review is to discuss 1) injuries, 2) the athletic trainer 3) college athletes, 4) intervention methods, 5) mental imagery. The purpose of this study is to determine current the level of mental imagery used by injured collegiate athletes during rehabilitation.

Injuries

Psychological Antecedents

Psychological antecedents and emotional reactions play a key role the rehabilitation of an athletic injury. As

reported in the *2006 Consensus Statement*, athletic activity could lead to physical injury and injury could lead to a variety of psychological issues (Herring, Boyahian-O'Neill, Coppel, Daniels, Gould, Grana, et al., 2006). Psychological factors, such as stress, could increase the athlete's risk of injury (Herring et al., 2006). Stress can lead to attentional changes that can interfere with an athlete's performance (Herring et al., 2006).

Psychological Issues of Rehabilitation

Psychological antecedents and emotional reactions play a key role in athletic injury rehabilitation. Herring et al. (2006) reports the use of psychological strategies such as goal-setting, positive self-talk, cognitive restructuring and imagery techniques are associated with faster recovery. The rehabilitation phase has its own set of problems including: unreasonable fear of re-injury, denial of the injury, general impatience and irritability, rapid mood swings, withdrawal from normal behavior, extreme guilt about letting the team down, and an obsession with questions of return to participation (Herring et al., 2006). Decisions on return to participation are usually made by the athletic trainer in conjunction with the team physician.

Athletic Trainer

Athletic trainers are allied health care professionals, recognized by the American Medical Association, who collaborate with physicians to optimize activity and participation of physically active patients and clients (NATA, 2009). The typical athletic training setting includes: professional sports, collegiate athletic, high school athletics, sports medicine clinics, as well as health/ fitness clinics (Prentice, 2006).

The six domains of athletic training are: (1) the prevention of athletic injury and conditions, (2) clinical evaluation and diagnosis of athletic injury conditions, (3) the immediate care of athletic injuries and conditions, (4) treatment rehabilitation and recognition of athletic conditions, (5) organization and administrative duties, and (6) professional responsibilities for the profession (NATA, 2009).

Athletic trainers typically spend extended periods of time with athletes under conditions that promote personal interactions and trust (Moultan, Molstad, & Turner, 1997). According to the National Athletic Trainers' Association Education Counsel (2009), entry level athletic trainers should possess certain skills necessary for successful

performance in athletic training. Each of the six domains of performance has psychological competencies associated with it. They include recognizing the psychological signs and symptoms of athletic injury, practicing effective communication skills in the areas of health maintenance, and provide athletes with injury prevention education in relation to athletic injury.

Athletic training educational competencies and clinical proficiencies (competencies) are a set of skills to be mastered by students in entry-level athletic training programs (NATA, 2009). The Competencies provide the certified athletic trainer with the essential knowledge and skills needed to provide athletic training services to patients of differing ages and genders and work, and lifestyle circumstances and needs (NATA, 2009). The Commission on Accreditation of Athletic Training Education (CAATE), requires that the Competencies be used for curriculum development and education of the student enrolled in an accredited entry-level education program (NATA, 2009).

The competencies are categorized into foundational behaviors of professional practice and are divided into twelve content areas. The twelve content areas are (1) risk management and injury prevention, (2) pathology of

injury and illness, (3) orthopedic clinical examinations and diagnosis, (4) medical conditions and disabilities, (5) acute care of injuries and illness, (6) therapeutic modalities, (7) conditioning and rehabilitative exercise, (8) pharmacology, (9) psychosocial interventions and referral, (10) nutritional aspects of injuries and illnesses, (11) health care administration, and (12) professional development and responsibilities. (NATA, 2009)

Psychosocial interventions and referral will be the focus of the current study. Cramer-Roh and Perna (2000) concluded that psychological factors may either hinder or facilitate recovery. Life stress associated with academic pressure and the decreases in playing time are a few stressors the college that may affect the athletes rate of recovery. Cramer-Roh and Perna (2000) also state that athletic trainers may benefit from structured education experiences specific to the NATA psychology/counseling competencies.

Athletic trainers involved in a 1997 Moultan, Molstad, and Turner study acknowledged a preference for counseling athletes whose psychological and emotional problems were directly associated with sport injury(Moultan et al., 1997).

College Athletes

Collegiate athletes can present to a counselor with the same developmental issues non-athletes face. (Fletcher, Benshoff, & Richburg, 2003) These issues may include developing independence or establishing one's sense of self. Athletes encounter a variety of psychosocial and emotional challenges as a function of participation in sports (Petitpas & Champagne, 1988). Athletes and non-athletes face many of the same developmental tasks as they move from childhood through adolescence to adulthood (Goldberg, 1991). An understanding of Erikson's theory of psychosocial development will help in understanding the development of the college student. Erickson's theory includes the following: (1) basic trust vs. mistrust, (2) autonomy vs. shame and doubt, (3) initiative vs. guilt, (4) industry vs. inferiority, (5) identity vs. identity confusion, (6) intimacy vs. isolation, (7) generativity vs. stagnation, and (8) ego integrity vs. despair (Munley, 1975).

Stage five, identity vs. identity confusion, relates to adolescence (ages 12-18). In this stage an individual must search of an identity that will lead them to adulthood. Stage six, intimacy vs. isolation, relates to

early adulthood (ages 19-40) (Cramer, Flynn, LaFave, 1997). In this stage the individual searches for companionship in another individual. During the college year these two stages are most important for their development (Cramer et al., 1997).

By the time a student reaches college age, he/she should have reached the stage of formal operational thought. Formal operational thought is the final stage of cognitive development in which an individual learns a skill known as hypothetico-deductive reasoning (Cook & Cook, 2005). Hypothetico-deductive reasoning is a skill that must be mastered for in order for an individual to be able to plan for future event accurately. This particular type of reasoning allows a person to predict the outcome of a situation that has more than one multiple variables acting on it (Cook & Cook, 2005). For example, if an athlete wants to participate in an athletic event he/she must be eligible for participation. Eligibility is determined by the athlete's academic standing at the institution, which can include attendances, grades, and personal conduct. An athlete knows that he/she must attend class, maintain his/her grades, and exhibit appropriate conduct to be eligible participants.

College students and college student athletes have the same academic responsibilities when it comes to class work, attendance, and conduct on campus. Student athletes may have some leniency when it comes to excused absences due to athletic competitions, none-the-less, they are still responsible for completing their class assignments. In addition, athletes may need assistance in dealing with a series of issues including: athletic competition, career development, psychosocial development, retirement from sport, and personal clinical issues (Chartrand & Lent, 1987).

The collegiate student athlete must also cope with additional influences that affect their cognitive, social, moral, educational and psychosocial development during their college years (Fletcher et al., 2003). Fletcher et al. (2003) stated an athlete's emotional well-being is closely linked to their success on the field. Athletes often deal with fear and disappointment that may come with their team loosing an important game or fear of performance anxiety. The fear associated with performance is the fear of losing the playing time because of injury, fear of being cut from the team, and the fear of being forced to retire (Fletcher et al., 2003). Retirement can be due to injury,

graduation from high school or college, or retirement from professional sports.

Intervention Methods

Student-athletes are the most recognized populations on college campuses (Fletcher et al., 2003). They attract honors and praise for their successes along with resentment of their privileges and special treatment (Fletcher et al., 2003). College students and college student-athletes are at the same fundamental age therefore they face the same developmental issues. The difference is that the consuming nature of athletics hinders the college student athletes' mastery of the developmentally appropriate skills such as developing his/her sense of self (Fletcher et al., 2003). Johnson (2000), on the other hand, makes the distinction that the athletic population would more readily adhere to a mental imagery protocol because the practice necessary to master these psychological skills resemble the practice of their sport.

Mental Imagery

Mental imagery is defined as creating an image within the mind without external stimuli. Mental imagery has been used in training and competition; however, little research has been published describing mental imagery in the context of rehabilitation. Mental Imagery techniques can be used as preventive treatment for stress associated with trouble between teammates, coaches, fans, loss of playing status, or the event itself (Green, 1992). Throughout the search for literature on mental imagery, three categories of imagery have surfaced: cognitive imagery, healing imagery, and motivational imagery. The purpose of this review is to provide information about the three categories of imagery and how each can benefit the athlete during injury rehabilitation.

Cognitive Imagery

Cognitive Imagery is the use of mental imagery to enhance specific sports skills and to plan strategies before during and after competition (Cox, 2001). Cognitive imagery can be use before and during the performance of a sports skill. Imagery can be used as practice between competitions or immediately before a performance to ensure

proper skill execution (Malouff, McGee, Halford, & Rooke, 2008). In 2008, Malouff et al. used a group of 115 participants who were enrolled in a tennis serving competition which tested the effectiveness of three mental rehearsal techniques. The three condition groups were self-instruction, imagery, and serve as usual. A random number table was used to assign each of the participants to one of the three condition groups. The first group was instructed to use one of the cues from the this list: see the target zone, line up toes, toss the ball to contact height, straight toss, bend, see the ball, see where to contact the ball, reach up contact the ball where you want (Malouff et al, 2008). The second group had the participant imagining the entire serve from beginning to end. The participant should visualize how he/she would move, what he/she sees, and how it feels to go through each movement (Malouff et al., 2008). The third group was considered the control or no intervention group. These participants were instructed to serve as they would normally.

According to the results of the Malouff et al. (2008) study, the tennis players that used positive imagery ($p=.01$) and self instruction ($p=.032$) performed better during competition than the tennis player that served

without the intervention. Malouff et al. (2008) also reported no significant difference between the positive imagery and the self-instruction group.

A 1980 study on mental imagery by Weinberg, Gould, Jackson, and Barnes reported different results. Malouff et al. (2008) credited these differences to the dissimilarities between the two studies. The differences noted were: the imagery in the present study had a positive outcome, the self-instructions condition involved one instruction at a time rather than a set of instructions, each participant received each condition, there was no competition, the serving outcome measured both speed and accuracy, and previous study included beginners while the present study included participants that have participated in a competitive league (Malouff et al., 2008).

Fear of physical injury seems to be a common source of worry, even a possible reason for leaving the sport (Chase, Magyar, & Drake, 2005). In a 2005 study, Chase et al. interviewed gymnasts ages 12-17. All participants in the study were from the Midwest and competed at level 7-10. These subjects had a training age of approx 8.7 years. In this study the gymnasts were asked questions about the types of injuries occurring in gymnastics, reasons they participate, their fear of injury, sources of self-efficacy

(i.e., self-confidence); and mental/physical strategies used to overcome fear of injury.

A person's self-efficacy will help them overcome the fear of injury and associated anxiety. There are four factors known to affect ones self-efficacy: performance accomplishments, vicarious experience, verbal persuasion, and physiological arousal/emotion. In order to conquer the fear of injury, athletes must learn skills to manage the fear. Mental imagery/rehearsal is one technique adopted by athletes to manage fear as well as improving performance and self-confidence (Chase et al., 2005). These techniques are often implemented by athletic trainers and as well as sport psychologist.

Healing Imagery

The scope of practice of certified athletic trainers includes aspects of sport psychology techniques practiced by sport psychologists. Mental imagery can be implemented with injured athletes during rehabilitation to promote healing, to control stress, and to promote and maintain a positive mindset (Hamson-Utley & Vazquez, 2008). There are studies that credit shorter recovery times from injury, surgical procedures, and disease to the use of healing imagery during. Egbert, Battit, Welch and Bartlett (1964)

(as cited in Kiecolt-Glaser, Page, Marucha, MacCallum, and Glaser, 1998) reported that anesthesiologists paid brief visits to patients and provided them post surgical information and taught them relaxation techniques to reduce pain. The patients that received these extra visits required less pain medication and left the hospital and average of 2.7 day sooner that the patients receiving routine care (Egbert et al., 1964).

Scherzer, Brewer, Cornelius, Van Raalte, Petitpas, and Sklar et al. (2001) completed a study measuring the correlation between psychological skills used and adherence to the rehabilitation program. Fifty-four participants were going through rehabilitation for an anterior crutiate ligament (ACL) repair. The ACL is the ligament that the knee that limits forward movement between femur (thigh bone) and the tibia (shin bone). The Sports Injury Survey used in the study measured goal setting, healing-imagery, and positive self-talk. This study suggested that the effect of imagery on rehabilitation occur separately from how closely the athlete follows rehabilitation program (Scherzer et al., 2001).

Driediger, Hall, and Callow (2006) proposed that imagery can be used to decrease the amount of stress associated with injury. Athletes undergoing rehabilitation

in this study consistently described using imagery before or during their rehabilitation sessions to help control their technique. When used this way, imagery use could help decrease the chance of reinjury (Driediger et al., 2006).

Ievleva and Orlick (1991) examined whether athletes with fast-healing knee and ankle injuries demonstrated greater use of psychological strategies and skills than those with slow-healing injuries. The results of the study revealed that fast-healing athletes used more goal setting, positive talk strategies, and more healing imagery than did slow-healing athletes (Ievleva & Orlick 1991). These results suggest mental imagery can have a positive effect on the rate of healing.

Pain Management

Pain is one of the most frequently observed conditions by sports medicine providers when treating athletes (Brewer, Jeffers, Petitpas, & Van Raalte, 1994). Law et al. (2006) used the Athletic Injury Imagery Questionaire-2 in conjunction with the VAS and the LEFS. The VAS for pain is a ranking system that allows the client to give a visual representation of their pain level. A typical item in a VAS is a line with marked with the values zero through ten.

The client places a mark on the line that visually represents his/her current pain level. The LEFS is a series of tests used the check client's ability to perform certain movements with the leg.

These questionnaires were used to determine if athletes who used imagery for pain management employed more cognitive, motivational, and healing imagery than the athletes did not (Law et al., 2006). The Law et al. (2006) study further states that athletes who employed imagery to alleviate pain were more satisfied with their rehabilitation than athletes who did not use imagery.

Athletes often experience pain during different phases of the rehabilitation program. The purpose of the early phase of rehab is it to control pain and the other initial signs of inflammation (Prentice, 2005). Law et al. (2006) reports mental imagery should be used by injured athletes to manage pain; however these results do not translate to improved functionality or changes in the athletes' degree of pain. Law et al. (2006) proposed that imagery use during rehabilitation does increase the athletes' satisfaction with the rehabilitation program.

Motivational Imagery

Mental imagery and mental rehearsal has many uses in athletics. Motivational Imagery is the use of mental imagery to experience goal attainment, effective coping, and/or arousal management.

Syrjala, Donaldson, Davis, Kippes and Carr (1995) studied 94 patients that have been diagnosed with cancer. Each of the participants recently had or were preparing for their first bone marrow transplantation (BMT). A bone marrow transplant is a surgical procedure that replaces lost or damaged bone marrow tissue. The interventions associated with this study are treatment as usual (TAU), therapist support (TS), relaxation and imagery(R&I), and cognitive behavior skills training (CB). The R&I group received pre-hospital training sessions that included one-on-one interactions, written instructions, audio relaxation tapes and home practice. Patients were provided with information about the pain and nausea associated with the treatments. Each patient was seen twice a week for 20-40 minutes (Syrjala et al., 1995). In the first session patients were instructed to use deep breathing and progressive relaxation techniques. The second session involved autogenic relaxation, a technique which involves

passive concentration and body awareness of a specific sensation (Syrjala et al., 1995).

Syrjala et al. (1995) reported both the cognitive behavior training (p=.0071) and the relaxation and imagery (p=.0088) groups experienced a reduction in pain after their BMT. The difference between the CB and R&I group was not significant. Neither CB nor R&I groups reported a significant change in nausea during their treatment. The information for pain and nausea was confirmed in an analysis of the patients' perceptions of the helpfulness of the treatments for coping with the symptoms.

Stress and anxiety

Hinderliter and Cardinal (2007) purposed six concepts are: social support, confidence and competence, refer, accommodate, psychological skills, and educate. The concepts identified can be used by athletic trainers when working with athletes. With the increased interactions of between the athlete and the athletic trainers they should be able to determine which of these concepts the athlete needs the most work.

Social Support implies the use of a group of people the athlete trusts and are capable helping when needed. The athlete’s support group can include teammates, coaches,

parents, and people who have experienced the same type of injury. Social support is most often used during situations involving substance abuse, bereavement, terminal illness, parenting, and spirituality (Hinderliter & Cardinal, 2007). According to Bloom, Horton, McCrory, and Johnston (2004), support groups may be as beneficial for physical injuries as they have been for substance abuse rehabilitation (Bloom et al., 2004).

The clinician could enhance the process of improving the patients' *confidence and competence* which can positively influence the recovery process (Hinderliter & Cardinal, 2007). The clinician skilled in modeling confidence and competence can facilitate the patient's development of the same characteristics. Early success in the rehabilitation process can be used to boost the athlete confidence, which could further motivate them to complete their rehabilitation.

In some case the clinician is unable to handle the psychological distress associated with injury. In such cases, it is important for the clinician to recognize when to *refer* the individual to an outside source (Hinderliter & Cardinal, 2007).

Each athlete that enters the athletic training room has a unique. If at all possible a clinician's should

accommodate these needs, to promote the relationship between the clinician and the athlete. For an example a person may prefer heat application instead of cold application (Hinderliter & Cardinal, 2007). The clinician needs to have the ability to explain why what the athlete wants may not what is best for them at that particular moment (Hinderliter & Cardinal, 2007). For example, the athletic trainer needs to inform the athlete when cold therapy is indicated instead of heat therapy.

Psychological skills such as imagery, relaxation, and goal-setting can have a positive influence on the recovery of an injury. The clinician needs to have adequate skills to effectively implement this technique (Hinderliter & Cardinal, 2007). One proposed method is the use of a rehabilitation journal to keep track of the recovery process.

The final of Hinderliter and Cardinal's six concepts is the need to *educate* to the athlete about the situation. When the athlete has a clear understanding of the injury, they will know what to expect in each phase of healing. The athletic trainer should speak clearly and avoid technical jargon (Hinderliter & Cardinal, 2007).

Positive Mind Set

Following injury, an athlete may have negative thoughts including the fear of loss of playing status. Green (1992) proposed a method of creating mental images of oneself for each phase of healing. For example; an athlete has just injured his ankle. His "possible self #1" should decrease pain and swelling. His "possible self #2" is responsible for getting back on the field. The third possible self is responsible for getting back to full speed and so on (Green, 1992). This technique provides that athlete with a mental representation of each goal he/she wants to accomplish.

Mental Imagery and Rehabilitation

A decrease in the ability of to maximally activate a muscle is a well-known complication of therapeutic immobilization (Newsom, Knight, & Balnave, 2003). Immobilization is often necessary following a severe athletic injury. "An observation that training involving imagined muscle contractions can result in increases in strength comparable to those elicited by physical training has been interpreted as indicating that mental imagery can influence the design, and planning of rehabilitation protocol" (Yue & Cole, 1992). Newsom et al. (2003)

proposed mental imagery may limit strength loss in immobilized muscles by stimulating the central pathways responsible for motor control and prevent neuro-motor adaptations.

The Newsom et al. (2003) study used 17 participants, 13 female and 4 males. Each participant had their non-dominant arm casted from metacarpals (the bones in the palm) to just below the elbow. The clinician asked participants to imagine squeezing a rubber ball as tightly as possible (Newsom et al., 2003). The participants were reminded to avoid actual muscle contraction. The treatment sessions were 3 times a day for 5 minutes each. The results of this study state there was a 16.3% loss in grip strength in the control, and a 1.5% loss on grip strength for the experimental group. These results suggest mental imagery may be beneficial in reducing the loss of strength associated with immobilization (Newsom et al., 2003).

Central factors within the brain have been implicated in the strength gains occurring in response to mental imagery (Newsom et al., 2003). Imagined activities result in cortical activity that is specific to the areas associated with the muscle being mentally exercised (Dachateau, 2002). Yue and Cole also compared three types of strength training: physical strength training, mental

strength training, and imagined strength training. They found that the initial phase of both training regimens were identical. They hypothesized that the changes in central programming were responsible for the strength gain observed in the imagery (Yue & Cole, 1992).

Summary

Mental imagery is defined as creating an image within the mind without external stimuli. Mental Imagery has been used in training and competition however little research has been published describing mental imagery in the context of rehabilitation. The purpose of this review was to provide information about the three categories of imagery and how each can benefit the athlete during athletic injury rehabilitation. Motivational, cognitive, and healing imagery were the three headings discussed in this literature review. Each type of imagery plays a specific role in the rehabilitation of athletic injury.

Cognitive imagery can be used to help an athlete regain skills that have diminished during the period of time that the athlete was injured. Cognitive imagery is the use of mental imagery to experience specific sports skills and to plan strategies before during and after

competition. When an athlete is injured they are sometimes unable to perform in their sport. Cognitive imagery could be a method used to allow them to experience their sport without the risk of reinjury.

Motivational imagery can be implemented with injured athletes during rehabilitation to promote healing, to control stress, and to promote and maintain a positive mind set (Hamson-Utley & Vazquez, 2008) Athletes have to deal with pressure from coaches, parents, and their personal desire to return to participation. One of the attributes of healing imagery is its ability to help an athlete maintain a positive mood and stay focused on the outcomes of the rehabilitation program.

Motivational imagery can be used to help the athlete get through difficult parts of their rehabilitation. Motivational imagery is the use of mental imagery to experience goal attainment, effective coping, and/or arousal management. If an athlete reaches a plateau in their rehabilitation, motivational imagery can be used to refocus their efforts on completing the task and helping reach the next step toward returning to participation.

At stated above, mental imagery has multiple uses in athletic injury rehabilitation. College students deal with a variety of psychological issues including stress, anxiety

and in some cases depression. College student athletes deal with the pressure of performing at high level on the playing field as well as maintaining the appropriate academic standing to be eligible for participation.

Psychological issues have been related to physical injury; therefore we should teach effective coping techniques to our athletes to reduce the risk of injury. Injured athletes work with athletic trainers on a daily basis to rehabilitate injures. The purpose of this literature review was to discuss 1) injuries, 2) the athletic trainer, 3) college athletes, 4) intervention methods, 5) types of mental imagery. The purpose of this study is to determine current level of mental imagery use among injures collegiate athletes. Athletic trainers are often the first to notice problems; and with the proper knowledge can inform the athlete about the resources available, as well as teach techniques to the student can use in their life outside of sports. Furthermore, CAATE standards discuss the need for athletic trainers to be competent and proficient when dealing with psychological issues concerning athletes and the physically active population.

APENDIX B

The Problem

Problem Statement

The psychological response to injury can lead to further injury or a lengthen rehabilitation. The mental imagery techniques discussed in this study can be implemented to help athletes deal with the stressor associated with injury and injury rehabilitation. The techniques developed can stay with the athlete as he/she transitions to the next phase of his/her life.

Definition of Terms

The following terms have been defined to help with the overall understanding of this particular study:

1. Mental Imagery – The total score of all items on the Athletic Injury Imagery Questionnaire-2.
2. Cognitive Imagery – The sub-score of items 2, 6, 7 and 10 on the Athletic Injury Imagery Questionnaire-2.
3. Healing Imagery – The sub-score of items 1, 4, 8 and 11 on the Athletic Injury Imagery Questionnaire-2.
4. Motivational Imagery – The sub-score of items 3, 5, 9, and 12 on the Athletic Injury Imagery Questionnaire-2.
5. Formal Mental Imagery training is defined as any interaction between a sport medicine professional (i.e. athletic trainers, sport psychologist, sport

therapist, physical therapist, or sports counselor) with the purpose of teaching skills that the athlete can use to cope with psychological issues associated with injury and injury rehabilitation.

Basic Assumptions

The following are the basic assumptions that can be made for this study:

1. All participants are currently undergoing rehabilitation for a current injury.
2. All participants will answer the each item on the Athletic Injury Imagery Questionaire-2 to the best of their ability.
3. Injuries reported will represent all levels of injury described on the American Sports Data Sports Injury Report.
4. Athletes have not received any formal training in mental imagery prior to this study.

Limitations of the Study

The following are the possible limitation of this study:

1. Only student-athletes that are currently going through rehabilitation were questioned.

2. Only student-athlete at California University of Pennsylvania were issued a questionnaire
3. All participants were volunteers

Significance of the Study

This study will increase the research of the mental imagery and it's the benefits receive from using psychological stress reduce techniques.

It is important for all sports medicine professional such as sports psychologists, sports therapists, sport counselors, athletic trainers to have an understanding of the psychological issues and how to assist athletes with these issues. Athletic trainers are often the first notice problems and with the proper knowledge can inform the athlete on the resources available and teach techniques for student-athletes to use in their lives outside of sports.

Appendix C

Additional Methods

Appendix C1

Informed Consent

California University of Pennsylvania
250 University Avenue
California, PA 15419-1394
www.cup.edu
DEPARTMENT OF HEALTH SCIENCE AND SPORT STUDIES
Building Character. Building Careers.
724-938-4562 | 724-938-4342 FAX

The Level of Mental Imagery Use by Injured Collegiate Athletes during Rehabilitation

Primary Researcher: Brandon McClendon

Letter of Informed Consent

The purpose of this study is to examine the level of mental imagery used by injured athletes during rehabilitation. This study will provide the reader with literature mental imagery and its importance during rehabilitation of athletic injuries.

The primary researcher is Brandon F. McClendon, Candidate for Masters of Science in Athletic Training.

I have selected you to participate in the study based on your enrollment in a rehabilitation protocol here a California University of PA. Participation is this study in voluntary. Participant can withdraw from this study and at any time during the process. Participants can inform Brandon McClendon (primary researcher) at any time if they wish to have their data removed from the data analysis.

All results will be kept confidential. During data analysis all data all names will be removed and replaced with a symbol.

Minimal risk is associated with participation in the study.

Participant should know that returning their questionnaire and signed letter of consent will be considered an indication of consent to use the data.

If you have any questions regarding this informed consent, questionnaire, or the study itself feel free to contact:

Primary Researcher:
Brandon McClendon BA, ATC, PES
Mcc3947@cup.edu
850.209.6228

Research Advisor:
Tom Kinsey Ph.D
Kinsey@cup.edu
412.720.1037

Completed Surveys will be housed in a locking filing cabinet in an office in Hamer Hall.

I understand that my participation in this study is voluntary, and by signing below I authorize the researcher to use the results of my questionnaire in the data analysis.

Approved by California University of Pennsylvania IRB Start Date: 3/20/2009 to End Date: 3/19/2010

Signature_____ Date_____

Appendix C2

Student Athlete Response Form

Demographic Sheet

Sport_____

Year(s) of Participation_____

Position_____

Injury_____

Length of Rehab_____

Select One	Severity of Injury	
	Level 1	Injury did not interfere with subsequent participation
	Level 2	Injury prevented participation on at least one or more future occasions, but for less than a month
	Level 3	Injury prevented participation for at least a month
	Level 4	Injury prevented participation for at least a month and resulted in emergency room treatment, overnight hospital stay, surgery and/or ongoing physical therapy

Have you had formal training in the techniques of mental imagery? _____

AIIQ-2

Various types of imagery exist. For example, an athlete may imagine himself perfectly performing specific actions, coping with difficult situations, and achieving various goals. Another type of imagery involves imaging the physiological repairing of one's injury. For example, an athlete may imagine his muscle repairing following a strain injury. The following questions concern any imagery you may have used during your current rehabilitation. If you **never incorporated mental imagery** in to your rehabilitation program, you would indicate this with a score of **one**. If you **rarely** used imagery, this would be reflected in a **low rating**, whereas a **high rating** would indicate **frequent use** of imagery in rehabilitation. Please indicate your response in the space provided beside each statement. There are no right or wrong answers. Feel free to record the same response a number of times if this is most accurate.

1	2	3	4	5	6	7	8	9
Never								**Always**

1. I imagine my damaged tissue returning to normal _____
2. Prior to performing a rehabilitation exercise, I am able to imagine myself completing it perfectly _____
3. I imagine coping with the stress associated with my injury _____
4. I imagine my body repairing itself _____
5. I imagine myself working successfully through tough situations (e.g., slower than expected recovery, further injury, etc.) _____
6. I imagine each rehabilitation exercise _____
7. I am able to imagine new rehabilitation plans and strategies in my head if they are prescribed to me _____
8. I imagine my body undergoing the healing process _____
9. I imagine myself achieving my treatment goals _____
10. I am able to change the image of a particular rehabilitation skill or exercise if necessary _____
11. I imagine the physiological changes my body is making during recovery (e.g., muscle or bone repairing) _____
12. I imagine handling the anxiety resulting from my injury _____

Appendix C3

Institutional Review Board:

California University of Pennsylvania

California University of Pennsylvania

Proposal Number 08-062
Date Received 2/16/09
expedited

PROTOCOL for Research Involving Human Subjects

Institutional Review Board (IRB) approval is required before beginning any research and/or data collection involving human subjects

(Reference IRB Policies and Procedures for clarification)

Project Title Level of Mental Imagery Use By Injured Collegiate Athletes During Rehab

Researcher/Project Director Brandon McClendon

Phone # 850-209-6225 ***E-mail Address*** mcc3497@cup.edu

Faculty Sponsor (if required) Dr Thomas Kinsey

Department H.S.S.

Project Dates 3/20/2009 ***to*** 3/19/2010

Sponsoring Agent (if applicable) _____

Project to be Conducted at California University of Pennsylvania

Project Purpose: ☑ ***Thesis*** ☐ ***Research*** ☐ ***Class Project*** ☐ ***Other***

Keep a copy of this form for your records.

Required IRB Training

The training requirement can be satisfied by completing the online training session at http://cme.nci.nih.gov/. A copy of your certification of training must be attached to this IRB Protocol. If you have completed the training at an earlier date and have already provided documentation to the California University of Pennsylvania Grants Office, please provide the following:

Previous Project Title _____

Date of Previous IRB Protocol _____

Approved, September 12, 2005

Please attach a typed, detailed summary of your project AND complete items 2 through 6.

1. *Provide an overview of your project-proposal describing what you plan to do and how you will go about doing it. Include any hypothesis(ses)or research questions that might be involved and explain how the information you gather will be analyzed. For a complete list of what should be included in your summary, please refer to Appendix B of the IRB Policies and Procedures Manual*

2. *Section 46.11 of the Federal Regulations state that research proposals involving human subjects must satisfy certain requirements before the IRB can grant approval. You should describe in detail how the following requirements will be satisfied. Be sure to address each area separately.*

    a. *How will you insure that any risks to subjects are minimized? If there are potential risks, describe what will be done to minimize these risks. If there are risks, describe why the risks to participants are reasonable in relation to the anticipated benefits.*
    b. *How will you insure that the selection of subjects is equitable? Take into account your purpose(s). Be sure you address research problems involving vulnerable populations such as children, prisoners, pregnant women, mentally disabled persons, and economically or educationally disadvantaged persons. If this is an in-class project describe how you will minimize the possibility that students will feel coerced.*
    c. *How will you obtain informed consent from each participant or the subject's legally authorized representative and ensure that all consent forms are appropriately documented? Be sure to attach a copy of your consent form to the project summary.*
    d. *Show that the research plan makes provisions to monitor the data collected to insure the safety of all subjects. This includes the privacy of subjects' responses and provisions for maintaining the security and confidentiality of the data.*

3. *Check the appropriate box(es) that describe the subjects you plan to use.*

☐ *Adult volunteers*	☐ *Mentally Disabled People*
☑ *CAL University Students*	☐ *Economically Disadvantaged People*
☐ *Other Students*	☐ *Educationally Disadvantaged People*
☐ *Prisoners*	☐ *Fetuses or fetal material*
☐ *Pregnant Women*	☐ *Children Under 18*
☐ *Physically Handicapped People*	☐ *Neonates*

4. *Is remuneration involved in your project?* ☐ *Yes or* ☑ *No. If yes, Explain here.*

5. *Is this project part of a grant?* ☐ *Yes or* ☑ *No If yes, provide the following information:*

    Title of the Grant Proposal _____

    Name of the Funding Agency _____

    Dates of the Project Period _____

6. *Does your project involve the debriefing of those who participated?* ☐ *Yes or* ☑ *No*

    If Yes, explain the debriefing process here.

7. *If your project involves a questionnaire interview, ensure that it meets the requirements of Appendix __ in the Policies and Procedures Manual.*

Approved, September 12, 2005

Project Director's Certification
Program Involving HUMAN SUBJECTS

The proposed investigation involves the use of human subjects and I am submitting the complete application form and project description to the Institutional Review Board for Research Involving Human Subjects.

I understand that Institutional Review Board (IRB) approval is required before beginning any research and/or data collection involving human subjects. If the Board grants approval of this application, I agree to:

1. Abide by any conditions or changes in the project required by the Board.
2. Report to the Board any change in the research plan that affects the method of using human subjects before such change is instituted.
3. Report to the Board any problems that arise in connection with the use of human subjects.
4. Seek advice of the Board whenever I believe such advice is necessary or would be helpful.
5. Secure the informed, written consent of all human subjects participating in the project.
6. Cooperate with the Board in its effort to provide a continuing review after investigations have been initiated.

I have reviewed the Federal and State regulations concerning the use of human subjects in research and training programs and the guidelines. I agree to abide by the regulations and guidelines aforementioned and will adhere to policies and procedures described in my application. I understand that changes to the research must be approved by the IRB before they are implemented.

Professional Research

Project Director's Signature

Department Chairperson's Signature

Student or Class Research

Student Researcher's Signature

Supervising Faculty Member's Signature if required

Department Chairperson's Signature

ACTION OF REVIEW BOARD (IRB use only)

The Institutional Review Board for Research Involving Human Subjects has reviewed this application to ascertain whether or not the proposed project:

1. provides adequate safeguards of the rights and welfare of human subjects involved in the investigations;
2. uses appropriate methods to obtain informed, written consent;
3. indicates that the potential benefits of the investigation substantially outweigh the risk involved.
4. provides adequate debriefing of human participants.
5. provides adequate follow-up services to participants who may have incurred physical, mental, or emotional harm.

as amended

☒ Approved ☐ Disapproved

Chairperson, Institutional Review Board

03-20-09
Date

Approved, September 12, 2005

The Level of Mental Imagery Use by Injured Collegiate Athletes during Rehabilitation

Primary Researcher: Brandon McClendon

Research Overview

Methods

The purpose of this study is to examine the level of mental imagery used by injured athletes during rehabilitation. This study will provide the reader with literature on mental imagery and its importance during rehabilitation of athletic injuries.

Research Design

This research is a descriptive study. The first set of variables is severity of injury and length of rehabilitation in weeks. The second set variables include the motivational, cognitive, and the Healing imagery scores. There will be an assessment for correlation between severity of injury and all the imagery scores, and length of rehabilitation and all three imagery types.

Subjects

The participants of this study will be California University of Pennsylvania (CALU) student athletes currently going through rehabilitation for injuries. Subjects will be volunteers with an age range of 18-22. All participants will be college age student-athletes.

Instruments

The Athletic Injury Imagery Questionnaire-2 (AIIQ-2) is comprised of 12 items concerned with the injured athlete's current use of imagery. Items are representative of the three functions of imagery: motivational imagery (MI), cognitive imagery (CI), and healing imagery (HI). Items 3, 5, 9, and 12 are Motivational Imagery items; items 2, 6, 7 and 10 Cognitive Imagery items; and items 1, 4, 8 and 11 are Healing Imagery items. According to Sordoni et al (2002), the creators if the AIIQ-2, the reliability coefficient for the three subsections motivational= .82, cognitive=.84, & healing=.91. (Sordoni)

The American Sports Data Sports Injury Report has established four levels of injury. Level 1, Injury did not interfere with subsequent participation. Level II, Injury prevented participation on at least one or more future occasions, but for less than a month. Level III, Injury prevented participation for at least a month. Level IV, Injury prevented participation for at least a month and resulted in an emergency room treatment, overnight hospital stay, surgery and/or ongoing physical therapy. The demographic sheet will have a section that will allow the participant to select their injury severity. (Lauer)

Procedures

After attaining approval from the Institutional Review Board and received permission from the Dr Tom Pucci Athletic Director, participants from the institution will be selected based on their injury status at CALU. The Certified Athletic Training Faculty and Graduate Assistants at CALU will be contacted to determine if they have athletes that are currently going through rehabilitation.

The following steps will be taken in order to ensure the privacy of each participant and the accurate completion of the questionnaire:

1. The Athletic Training faculty and Graduate Assistant Athletic Trainers will contacted by the researcher for a list of eligible student athletes.
2. The Athletic Training faculty and Graduate Assistant Athletic Trainers will inform the athletes to in order to set up an initial meeting with the researcher.
3. The researcher will inform the student athletes on the purpose of the study.
4. The researcher will meet with the student athletes participants individually on campus in a location agreed upon by the athletic trainer. Locations may include the athletic training room, weight room, and/or athletic meeting rooms.
5. In season athletes will meet before practice. Out of season athletes will meet in one of the locations previously mentioned.
6. The completed questionnaire packet will be housed in a locking file cabinet in an office in the Department of Health Science and Sports Studies.
7. After completing the questionnaire, participants will be given a ticket which will be put into a lottery drawing for a gift card.

The questionnaire packet will consist of a demographic sheet which will have the athletes' age, sport, years of participation, playing status, severity of injury, and length of rehabilitation. The second page of the packet is the AIIQ-2 questionnaire. The will be a copy of the questionnaire packet in the Appendix.

Hypothesis

The following hypotheses were based on previous research and the researcher's intuition based on the review of literature.

1. Athletes with higher rating for severity of injury will have a higher score for Cognitive Imagery.
2. Athletes with higher rating for severity of injury will have a higher score for Healing Imagery.
3. Athletes with higher rating for severity of injury will have a higher score for Motivational Imagery.
4. Athletes with shorter Rehabilitation of injury will have a higher score for Cognitive Imagery.
5. Athletes with shorter Rehabilitation of injury will have a higher score for Healing Imagery.
6. Athletes with shorter Rehabilitation of injury will have a higher score for Motivational Imagery.

The Level of Mental Imagery Use by Injured Collegiate Athletes during Rehabilitation

Primary Researcher: Brandon McClendon

Section 2

a. This study is based on responses given on a questionnaire. There is minimal risk involved with participating in this study. The results of this study will be a numerical score based on their score for each item on a 9 point Likert scale.
b. The subjects will be selected based on their enrollment in athletic injury rehabilitation protocol here at California University of PA. Students will be participating on a volunteer basis.
c. The cover letter of the questionnaire will state all information regarding participation in the study. If an athlete does choose not to participate in the study they do not have to sign the letter of consent. All questionnaires that will turned in without signing the cover letter will not be use in the data analysis
d. No participant's name will be used on the data collection sheet. All names will be replaced with P_1 P_2 P_3… etc. The participants will be listed in the order their survey is received. During data analysis there will no identifying marks or information will be on the data sheet.
e. Completes Surveys will be housed in a locking filing cabinet in the Department of Health Science and Sports Studies.

APENDIX C4

Athletic Director Consent Form

California University of Pennsylvania
250 University Avenue
California, PA 15419-1394
www.cup.edu

Building Character. Building Careers.

DEPARTMENT OF ATHLETICS
724-938-4351 | 724-938-5849 FAX

January 13, 2009

Mr. Brandon McClendon
P.O. Box 622
California, PA 15419

Dear Mr. McClendon:

Please note that this correspondence grants you permission to utilize California University of Pennsylvania's student athletes from the athletic department to participate in any research for your project in graduate school.

If any additional information is required, please do not hesitate to contact me. I wish you the best of luck and will assist in any way to make this successful.

Sincerely,

Thomas G. Pucci
Athlwe5tic Director/Professor
puci@cup.edu

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ABSTRACT

Title: THE LEVEL OF MENTAL IMAGERY USE BY INJURED COLLEGIATE DURING REHABILITATION

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Date: May 2009

Research Type: Master's Thesis

Content: Mental imagery has been shown as an effective tool in reducing the psychological issues associated with athletic injury. Mental imagery has multiple functions that can be used in athletics and in life after athletics.

Objective: The purpose of this study is to examine the level of mental imagery use by injured athletes during rehabilitation as it relates to length of rehabilitation and the severity if the injury.

Setting: The participants who complete this survey did so in a controlled laboratory setting in person.

Design: The correlation between mental imagery and severity of injury/length of rehabilitation was test using the Pearson product correlation. Mental imagery was divided into three sub-categories, motivation, cognitive, and healing imagery.

Participants: Forty injured collegiate athletes currently rehabilitation and injury working with an Athletic Trainer at California University of Pennsylvania

Interventions: The correlation between mental imagery and severity of injury/length of rehabilitation was test using the Pearson product correlation. Mental imagery was divided into three sub-categories, motivation, cognitive, and healing imagery.

Main Outcome Measures:	Questionnaire packet was divided into a demographic sheet demographic sheet was contained the two variables length of rehabilitation and severity of injury. The sub-scores received from the AIIQ-2 were the motivational sub score, the cognitive imagery sub-score and the healing imagery sub score. The researcher performed a Pearson Product moment correlation between the variables.
Results:	The primary findings of this particular study was that there was not a significant correlation between the reported length of rehabilitation and severity of injury and the cognitive imagery sub-score, motivational imagery sub score, and the healing imagery sub score.
Conclusion:	This study did not find a significant correlation between the severity of injury/length of rehabilitation and the use of the three mental imagery sub-categories. This results exposed several necessary modification to the current study. The results of this study showed a need for in training in mental imagery for athletes, and athletic trainers. As athletic trainers we should improve our awareness of psychological aspect of injuries. Athletic trainers are often the first to notice problems, and with the proper knowledge can inform the athlete about available resources and teach techniques beneficial to student-athletes for use in their sport as well as their life outside of athletics.