2020

Does Imagery Help Psychological Rehabilitation

Xeing Randy Yang
Bethel University

DOES IMAGERY HELP PSYCHOLOGICAL REHABILITATION

A MASTER'S (Capstone Project)

SUBMITTED TO THE GRADUATE FACULTY

OF THE GRADUATE SCHOOL

BETHEL UNIVERSITY

BY
XEING R. YANG

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF SCIENCE IN ATHLETIC TRAINING

MAY 2020

BETHEL UNIVERSITY

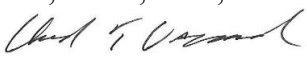
DOES IMAGERY HELP PSYCHOLOGICAL REHABILITATION

XEING R. YANG

May 2020

Approvals:

Project Advisor: Chad Osgood, Ed.D., LAT, ATC

Project Advisor Signature: 

Dean of Business, Leadership, Health, and Social Sciences: Chad Osgood, Ed.D., LAT, ATC

Dean of Business, Leadership, Health, and Social Sciences Signature: 

Athletic Training Program Director: Chad Osgood, Ed.D., LAT, ATC

Athletic Training Program Director Signature: 

Abstract

Background: In rehabilitation, athletic trainers should address the psychological aspect of rehabilitation as it is just as important as the physical aspect. Psychological responses an athlete can experience include anxiety, depression, frustration, tension, and a decreased level of self-esteem. These responses can lead to a decreased rate of return to the sport.

Purpose: The purpose of this critical review of the research was to examine the following clinical question: Can implementing imagery in rehabilitation in collegiate football players decrease reinjury anxiety in return to play after Anterior Cruciate Ligament Repair (ACLR) compared to standard rehabilitation?

Results: There were 20 articles that were assessed. Of the articles included, there was 1 observational design, 4 cohort studies, 3 cross sectional studies, 1 prospective correlational design study, 2 survey studies, 5 systematic reviews, and 4 random control trials. The literature reviews areas of knowledge gaps as well as current trends in athletic training. Overall, results from the studies suggest that guided imagery was useful in helping decrease anxiety.

Conclusion: Reinjury anxiety is the number one predictor in return to play status as reported by athletes. Imagery has been shown to be associated with reduced reinjury anxiety, lowered stress levels, potential increased muscle activation, and potential decreased pain perception.

Implications: Imagery has been found to provide better results for rehabilitation and decrease anxiety levels. The results suggest that athletic trainers can enhance the recovery of individuals

who have had ACL reconstructive surgery by providing strategic interventions that go beyond traditional rehabilitation. There is a need for more research to understand the potential use of imagery in different settings. Due to the lack of current research on this subject, this project can help to expand the use of imagery in rehabilitation settings in order to decrease anxiety among collegiate players with ACLR.

Keywords: Imagery, ACLR, reinjury anxiety

Table of Contents

List of Tables

Chapter One: Introduction

Each year an estimated 3 to 7 million sports-related injuries occur in the United States (Ardern et al., 2015). Injuries are an inevitable part of recreational and competitive sports as they are very common and are difficult to avoid. Athletes from all sports backgrounds have most likely had a major or minor injury that affected their lives in either a big or small way, regardless of their sport. Injuries range from minor sprains to full tears or broken bones. Athletes are bound to have injuries, and rehabilitation protocols currently are focused on the physical aspect of rehabilitation. As athletic trainers, we should focus on the psychological aspects of rehabilitation in addition to the physical aspects. Sports injuries cause pain and physical impairments, but they also have a psychological impact on the players.

The psychology of injury is becoming a popular research area that is guided by emotion and stress (Mcpherson et al., 2019). Other potential psychological responses of an injured athlete include: anxiety, depression, frustration, tension, and decreased self-esteem. Stress and a person's emotions can lead athletes to be more susceptible to injury (Nwachukwu et al., 2019). As stress levels increase, the risk for injuries also increases (Petrie, 1993). Higher stress from personal or situational events may result in the athlete being distracted. This distraction may cause more injuries either to the same affected area or to uninvolved structures.

It is vital for athletic trainers,team physicians, athletes, coaches, and administrators to understand that emotional reactions to injury will happen. A problematic response to injury is depression, which can magnify other responses and impact recovery (Mcpherson et al., 2019).

When athletes sustain significant injuries, there is time loss from sport that can cause the athletes to suffer both physically as well as emotionally, including a decreased quality of life.

Purpose

The purpose of this study is to provide an overview of the implications of psychological factors related to ACLR and what can be done to address the symptoms. One study suggest that elevated kinesiophobia in athletes may not be due to pain, because pain levels are often low at the time of return to sport (Hsu et al., 2016)Fear of re-injury is one of the most common factors that deter athletes from returning to their original sport (Hsu et al., 2016). However, the underlying reason for elevated kinesiophobia in athletes may not be due to pain, because pain levels are often low at the time of return to sport (Hsu et al., 2016). Athletes who have completed their rehabilitation program and can return to sport may experience psychological barriers that keep them from returning to play. Few athletic trainers attend to the reinjury anxiety experienced by many athletes. Anxiety can lead to depression and other related symptoms, causing the player to not return to play and have a deep psychological scar. The question this paper will address is if imagery can be used to decrease reinjury anxiety in collegiate football players after ACL reconstruction surgery compared to standard rehabilitation.

Needs for a Critical Review in Athletic Training

Research studies have found that psychological factors and kinesiophobia contribute to injured players not returning to play. Rodriguez et al. (2019) found that of the 44% reported not returning to preinjury activity, 24% reported that the main factor preventing their return was fear of reinjury and pain. The inability to return to previous levels of performance can be stressful and mentally frustrating for the athletes. It is crucial to take into consideration that psychological

aspects of injury can affect an athlete's performance. Incorporating a therapeutic intervention that targets the psychological effects on an athlete's ability to return to sport is necessary to assure that the patient is both physically and mentally prepared to return to activity (Rodriguez et al. 2019)

Nwachukwu et al. (2019) found that objective measures of physical impairment may not relate to patient-reported knee function. The study established that return to sport cannot be solely predicted by objective physical improvement after surgery. ACL reconstruction has an expected return rate to play around 12 months (Nwachukwu et al., 2019). By also focusing on the psychological aspects of rehabilitation, we can expect for players to return with full mental readiness to return to play and decrease the symptoms that can lead to kinesiophobia.

Significance to Athletic Training

Most injuries, the athletes can return to pre-injury levels of activity. In more serious cases, an athlete's playing career may be at stake, and the healthcare provider should be prepared to address these issues.

To date, there is a gap in the literature regarding studies investigating the sports participation outcomes of athletes who have not returned to their preinjury level one year after surgery. It is not clear how many of these athletes subsequently return to their preinjury level of sport and whether they continue to play in general (Ardern et al., 2015). Mcpherson et al. (2019) state that although psychological interventions can reduce pain and improve function after ACLR, it is unknown how psychological readiness influences the risk of second ACL injury.

There is also a gap in the literature regarding the effects of depression on ACLR outcomes. Depression can be an underlying factor that can lead to increased kinesiophobia. This

can help to find the right interventions can prevent the associated symptoms. This review aims to explore the use of imagery to decrease the time it takes to return to play and decrease anxiety among athletes.

Chapter 2: Methods

This chapter describes the literature review process for examining articles regarding mental imagery and the impact on athletes returning to play following ACL reconstruction surgery. Search strategies, inclusion and exclusion criteria, the types of articles used, and criteria used for evaluating research studies are discussed. Overall, 106 articles were accessed, however the search was narrowed to 20 based on the inclusion and exclusion criteria.

Search Strategies

The purpose of this review was to answer the question: Does mental imagery decrease return to play reinjury anxiety in collegiate football players after ACL reconstruction compared to standard rehabilitation? The following databases were used for article access: PubMed, Google Scholar, CINAHL, EBSCOhost, Bethel Library Article Search. Search terms included: ACLR, Psychology, Return to play, Imagery, Injury, Rehabilitation, and Fear of reinjury.

Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were determined by the need for recent studies that described the psychological factors of injuries and the return to play status. Articles that were published within the past 20 years (on or after 2000) were included. The keywords used to find studies from the search databases were: return to play, psychology, imagery and rehabilitation. Studies in the inclusion criteria involved psychological factors and their effect on return to play. Studies also had to include ACL reconstruction surgery and their interventions. Other studies also included articles that measured the use of imagery models to decrease anxiety and increased return to play status.

Exclusion criteria eliminated studies that included psychological factors related to orthopedic injuries. Studies older than 20 years and non-English studies were excluded. Studies that were not peer reviewed were also excluded.

Studies Selected

The initial database yielded 106 studies for the review. Based on inclusion and exclusion criteria, 20 studies remained to be included in the review.

Evaluation Criteria

There were multiple tools used to evaluate the strength of the studies. The main tool for grading was the John Hopkins Evidence Based Practice Model (Daemon Library, n.d.). The following tools also helped to evaluate the studies, including Critical Appraisal Skills Programme (CASP), and the Evidence-Based Practice Matrix Model utilizing the PEDro Scale (Pedro Scale, n.d.).

The Critical Appraisal Skills Programme (CASP) (Raab & Craig, 2016) test assesses the reliability of sources across the academic disciplines. This tool enables you to systematically assess the trustworthiness, relevance, and results of different articles. This tool uses 10 questions to appraise the articles. Grades that are defined were 9-10 were high quality, 7-8 were good quality and 6 or lower were low quality. The Pedro Scale (Pedro Scale, n.d.) is used to help identify which of the known randomized control trials are valid and have enough information to make their results interpretable. The Pedro scale has a system of 11 questions as a criteria list for quality assessments of randomized clinical trials (RCT).

The John Hopkins Evidence Based model is a powerful, problem-solving approach to clinical decision-making and is accompanied by user-friendly tools to guide individual or group

use (Daemon Library, n.d.). Even though this grading scale is used mainly for nursing programs, it is still considered a standard tool for evidence-based practice. The critical appraisal is systematically examining research to evaluate its trustworthiness, value, and relevance. High quality (Grade A) studies consist of articles that were: consistent, generalizable results; sufficient sample size for the study design; adequate control; definitive conclusions; and consistent. Good quality (Grade B) studies consisted of articles that were: reasonably consistent results; enough sample size for the study design; some control, definitive conclusions; reasonably consistent recommendations based on comprehensive literature review that includes some reference to scientific evidence. Finally, lower quality (Grade C) studies consisted of articles that had little evidence with inconsistent results; insufficient sample size for the study design; conclusions cannot be drawn. This grading scale was obtained from the John Hopkins Grading Scale Appendix (Daemon Library, n.d.).

The articles included one observational design, four cohort studies, three cross sectional studies, one prospective correlational design study, two survey studies, five systematic reviews, and four randomized control trials. All these studies were assigned with a grade level and level of evidence. These 20 studies evaluated herein are regarded as the highest quality evidence as they were at least a grade B or above, with a level evidence of 1, 2, and 3 RCT. (See Table A below)

Level of Evidence	Number of Articles
I	5
II	4
III	11

Total	20

Table A. Levels of evidence

Summary

The articles assessed looked into psychological factors after ACLR. The studies also included if imagery can be effective in decreasing anxiety and decrease the time it takes to return to play. Inclusion and exclusion criteria were used to narrow the articles down to 20. The articles were then evaluated and appraised for level of evidence utilizing multiple tools for the studies. The tools used were the CASP, CRAAP, and PEDro scale. The Grading scale used was from the John Hopkins Nursing Evidence Based Practice Model derived from the Daemen University Library.

Chapter Three: Literature Review and Analysis

This chapter focuses on the review and analysis of the articles gathered. The matrix used is an adaptation of an evidence-based synthesis matrix. The matrix gives a brief overview of each individual article. The studies will be categorized into five parts: Studies that describe the need for psychological interventions, mid-level studies regarding imagery use in rehabilitation settings, high level studies in the use of imagery in rehabilitation setting, mid-level studies in the use of imagery in decreasing anxiety, and high level quality studies regarding decreasing anxiety in athletes. The matrix of these articles can be found in the appendix as Table 1.

Studies Describing the Need for Psychological Interventions

Arden et al. (2014) examined if knee function, psychological factors, and demographic factors were related to returning to preinjury sport following anterior cruciate ligament reconstruction. Specifically, 164 participants completed a questionnaire at 1-7 years after primary ACLR. The questionnaire consisted of questions regarding knee self-efficacy, health locus of control, psychological readiness to return to sport, and fear of reinjury. Arden et al. (2014) determined that those who had more positive responses had better knee function in sport and recreational activities. The biggest factors for not returning to sports included not trusting the knee, fear of reinjury or new injury, and poor knee function. The study found that less than 50% of athletes returned to their preinjury sport or recreational activity after ACLR. Patients reporting lack of confidence or fear of reinjury may be at an increased risk of not returning to sport and may benefit from psychological interventions. The study received a Level III score in the John Hopkins Mode. The study also scored a Grade B as the results were consistent and had an adequate sample size for the study. The CASP score was 8/10.

Webster et al. (2018) did a similar study regarding identifying factors that influence psychological readiness to return to sport after ACLR. The study had 635 athletes (389 males, 246 females) who underwent ACLR and had been cleared to return to sport after surgery. The study assessed demographics, surgical timing, clinical factors, functional measures, and symptoms of pain and function. These measures helped to examine the association between these variables and the psychological readiness of the athlete. The scales were completed on a tablet by the patient upon arrival at the clinic. Measurements were made before the patient consulted with the treating surgeon. The study found that positive effects on psychological readiness determined the return to play status for the athletes. They found a higher preinjury sport participation and higher subjective knee scores for all those who had positive associations with ACLR. The only difference found was that females were a significant contributor to the non-return group,17% returned to play after ACLR compared to males (30%). Overall, this study had a large sample and found that patients with higher function were more likely to be ready to return to sport. The study received a Level III score and a Grade B in the John Hopkins Model. The CASP score was 7/10.

Garcia et al. (2015) determined the incidence of major depressive disorder (MDD) and to correlate depression symptoms with patient-related knee functions after ACLR. This was a cohort study and had 64 adult patients who underwent primary ACLR. The subjects were given the 16-item self-reported quick inventory of depressive symptomatology to assess the depressive symptoms. The inventory was taken at 6, 12, and 24 weeks postoperatively. Groups were formed by the score and outcome of the inventory measurement. The study's threshold for a diagnosis of MDD included a score that was less than 6 out of the 16 items. There were 27 patients categorized in the MDD group.

It was found that patients who reported more symptoms of depression also reported worse patient-rated knee function. Although MDD patients reported lower baseline functional scores than the non-MDD patients, both cohorts showed similar improvements at the 1-year postoperative functional measurements. It is also important to note that MDD patients had lower baseline functional scores compared to non-MDD patients. This study helped to fill the gap in knowledge regarding mental health concerns and their involvement with patients who sustained an ACL injury. Mental health issues are likely to play a role in regaining knee function and achieving higher functional score outcomes when returning to sport. Even though the study gave itself its own grade and level score, the John Hopkins Evidence Based Model was still used. The study received a Level III score and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 8/10.

Mcpherson et al. (2019) studied if psychological readiness to return to sport was associated with a second ACL injury. They wanted to determine if having a second injury would be connected with a lower psychological readiness than patients who did not have a second injury. They recruited 329 patients who had a primary ACLR; they followed the patients and administered the ACL-Return to Sport After Injury scale (ACL-RSI) at 12 months after surgery to assess psychological readiness to return to sport. The patients were followed for a minimum of 2 years after the surgery to monitor for further injury. The study found that of the 329 patients, 52 (16%) sustained a second ACL injury. The study concluded that second ACL injury was associated with lower psychological readiness to return to play in younger patients, as measured by the ACL-RSI scale. The study found that older patients (>20) did not have any difference in scores between groups. The study also found that younger patients (<20) had 3 to 6 times increased probability of second injury. Considering the results of this study, it could be helpful

to offer additional counseling to younger athletes before they return to play. The study received a Level III score and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 8/10.

Trigsted et al. (2018) explored if fear of reinjury was an important factor in determining return to play status after ACLR. Evidence from other musculoskeletal injuries indicates fear of reinjury is related to stiffened movement in individuals. This study investigated the relationship between fear of reinjury and jump-landing biomechanics. This study had 36 females, each with a history of ACLR within 1-2 years from surgery date. A 3D capture device was used to record kinematics and lower extremity muscle activation on the injured limb. Results found that fear had a significant negative relationship with knee flexion, hip flexion, and trunk flexion, as well as a positive relationship with hip adduction. Fear of reinjury had a significant, positive relationship with glute max pre-activation. The study did not find any significant relationship between fear of reinjury and the landing phase of jump landing. The study found that greater fear of reinjury is associated with stiffened movement patterns. Greater fear of reinjury was associated with greater quadricep pre-activation, which indicated a stiffened movement pattern. The results indicate that stiffened movement may be a risk factor for secondary ACL rupture. Patients may experience pain during certain movements of activity and avoid certain positions. As a result, this avoidance or movement restriction may have a lasting consequence to the injury. The study received a Level III score and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 8/10.

Ling et al. (2018) completed a randomized control study regarding psychological readiness after ACLR. The quality movement assessment (QMA) program was used to identify physical deficits that lead to faulty movement patterns. The study had 30 athletes who had

primary ACLR who completed an ACL Return to Sport after Injury Scale (ACL-RSI). The control group completed their survey before the session, and the intervention group completed the ACL-RSI a second time after completing the QMA program. The baseline ACL-RSI scores were not different between the groups. There was an increase in ACL-RSI scores in the control group than the QMA; there was a decrease in the intervention group but it was not significant. The QMA effect on the responses may be due to the self-awareness of the athletes of their physical deficit at 6 months after ACLR. It was concluded that this assessment did not significantly reduce the mean scores. Because of this limited effect, the QMA may not be as efficient in measuring return to play status. There can be other factors that decrease psychological readiness. The study received a Level I and a Grade B on the John Hopkins Evidence Based Model. The Pedro Scale found it to have 10 of the 11 questions answered.

Nwachukwu et al. (2019) examined the variables that affect return to sport after ACLR. The study was designed to evaluate the available evidence base for psychological factors in return to sport, identify psychosocial factors and their impact on ACLR, and finally to understand current methods used to assess psychosocial return to sport. A systematic review of the MEDLINE database using PubMed was used to find articles. Of the 999 studies identified, only 28 met the inclusion criteria. There was a total of 2,918 patients from the included studies. The study found that psychological factors play an important role in return to play after ACLR. Patients with lower ACL-RSI scores had a slower return to play status. This study found that kinesiophobia, the fear of pain or reinjury, may have led to avoidance of particular movements. The fear of reinjury was a major factor in determining the return to play status of the athletes. The study also found that elevated fear of reinjury and lack of confidence in the postoperative knee were predictive of an inability to return to preinjury sport status. Among studies evaluating

the impact of psychology on return to play (RTP), there was a delay in RTP as well as lower RTP rates for patients. These studies showed that fear of reinjury was the most commonly reported impediment to RTP. The study received a Level III score and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 7/10.

Mid-level quality studies on the use of imagery in rehabilitation settings

Monsza et al. (2009) determined that there was limited use of sport-specific imagery being used in rehabilitation. The purpose of the study was to explore which debilitative images were used during rehabilitation, compare the frequency usage of imagery, and examine the relationship with imagery and anxiety. There were 36 collegiate athletes from a NCAA Division I university, including 14 men and 22 women. All athletes completed the Sport Imagery Questionnaire (SIQ) and the Sport Anxiety Scale (SAS) to measure the amount of imagery used and the anxiety levels of the athlete. The primary finding was that the longer athletes were injured, the less imagery they used. It was found that most respondents did use some type of imagery during their rehabilitation program. In some cases, the images that they used were found to be debilitative but were used anyway.

The study found that somatic anxiety was positively related to days injured. This indicates that the longer an athlete was injured, the more he or she reported feeling physiologic responses of anxiety associated with returning to practice. Higher levels of somatic anxiety were related to increased rehabilitation time. It is important to note also that this study found that imagery use and confidence in returning to one's previous ability were more important in predicting anxiety related to returning to play. Health care providers should be aware that debilitating images may increase anxiety among athletes. The study received a Level III score and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 7/10.

Coronado et al. (2017) examined the efficacy of psychosocial interventions in improving patient-reported outcomes after ACLR. Psychosocial factors can influence physical functioning and return to sport/activity after anterior cruciate ligament reconstruction. This study is a systematic review that was performed in MEDLINE/PubMed, CINAHL, PsycINFO, and Web of Science from each database's inception to March 2017. Study eligibility was determined based on population, intervention, and outcome. There was a total of 893 articles identified, but only four met the inclusion criteria for the review. A total of 210 patients were examined ranging from 15-53 years. There were 148 males and 63 females total. This systematic review clearly demonstrates insufficient evidence for recommending rehabilitation management options for patients after ACLR.

Several studies in the review showed that psychosocial factors influence recovery. Factors such as psychological distress, fear of reinjury, confidence, self-efficacy, and self-motivation have been shown to be predictive of a meaningful outcome, including return to sport. All of the psychosocial interventions in the review incorporated an element of imagery as a primary technique. Due to the lack of studies and the lack of evidence, the study concludes that there is inconsistent evidence for the additive benefit of psychosocial strategies for improving physical function, pain, and self-efficacy. There was also limited evidence for improving postoperative quality of life, anxiety, and fear of reinjury. The literature was found to be unclear on the long-term effects of psychosocial interventions on return to sport activity. There was no conclusion that can be drawn concerning intervention effectiveness or adverse effects. The study received a Level II and a Grade A on the John Hopkins Evidence Based Model. The CASP score was 8/10.

Law et al. (2006) examined the relationship among injured athletes' imagery use, perceived pain, overall limb functioning, and satisfaction with rehabilitation. There were 83 participants (44 males and 39 females) from the University of Western Ontario who were included in the study. Athletes were asked to complete a questionnaire consisting of four sections. The first section of the questionnaire involved demographic information, such as their age, gender, level of competition, sport, and length of rehabilitation. The second section consisted of the Athletic Injury Imagery Questionnaire-2 that assesses the functions of imagery employed in injury rehabilitation. The third section is the Visual Analogue Scale which measured the perceived pain during rehabilitation. The final section consisted of the Lower Extremity Functional Scale, which assesses the overall function of the injured area.

The study concluded that participants who used imagery for pain management had significantly more cognitive, motivational and healing imagery. This suggests that athletes who employ imagery may use it for additional purposes, such as coping with pain. However, the use of pain imagery was more associated with enhanced satisfaction with the rehabilitation experience than the pain itself. The study suggests that imagery can be used by injured athletes as a strategy to help them cope during rehabilitation and to enhance their satisfaction with their rehabilitation program. Further research is needed to better understand the various ways imagery may benefit athletes during injury rehabilitation. The study received a Level III score and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 7/10.

Sordoni et al. (2000) wanted to discover the following: if athletes used motivational and cognitive imagery during rehabilitation, if imagery was used more in higher levels of competition, and if athletes who used imagery previously would be more likely to incorporate it in their treatment regimen. The study had 71 athletes, 62% men (n = 44) and 38% women (n =

27), receiving physiotherapy treatment at the Fowler Kennedy Sport Medicine Clinic in London, Ontario, participated in the study. A three-part survey regarding the use of imagery during athletic injury rehabilitation was developed specifically for the present study. The first part of the survey included demographic and background information including: gender, age, sport, and level of competition. The second part was the Athletic Injury Imagery Questionnaire (AIIQ), which examined the injured athlete's current use of imagery. The final part was designed to explore how the participants previous use of imagery in sport was related to their current use of imagery as part of their respective rehabilitation regimens.

The study found that injury rehabilitation is consistent with the participants use of imagery in other aspects of sport, however athletes tend to use imagery less frequently in the context of injury rehabilitation. These results indicate that athletes seem unable to translate the use of imagery from training to injury rehabilitation. Therefore, athletes need to be reminded and encouraged to use imagery during injury rehabilitation. The study also found that imagery can facilitate managing stress levels, increasing self-confidence, and setting realistic goals. The study concludes that motivational imagery is employed to increase relaxation, decrease anxiety, aid in managing depression, increase self-confidence, increase motivation, and relieve pain. The study received a Level III score and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 8/10.

High Level quality studies on the use of imagery in rehabilitation settings

Veraksa & Gorovaya (2011) study was designed to investigate the assumptions that there exists a significant connection between the use of imagery by athletes, and to establish the efficacy of imagery training on performance. The first study had 41 male young soccer players. This study used the Sports Imagery Questionnaire (SIQ). The groups were split into an

experimental (imagery program) and the control group. The studies confirmed the assumptions that there was a significant connection between the use of the types of mental imagery no matter of the age. It was found that imagery was most effective with beginners. The soccer players used both cognitive and motivational images, and results yielded that younger players used more motivational images then later combined with cognitive images. The study concludes that the use of imagery training programs by soccer players leads to considerable increase in results of sport performance. The study received a Level II score and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 9/10.

Multhaupt & Beuth (2018) reviewed the current studies on the use of imagery in the rehabilitation of sports injuries. The study used the PICO format and found articles on databases from the following: LIVIVO, PubMed, PsycInfo, PubPsych. Out of a total 2714 studies found, only a total of 6 studies were found to fit all inclusion data. The number of participants lies between 2 and 30 people in each of the studies. No significant group differences are reported in the study by Cressman & Dawson, but there is a tendency for the intervention group to be more satisfied with rehabilitation program. The study also states that athletes using imagery also have a positive attitude towards rehabilitation. There were no differences that were found regarding the maximum muscular strength of a training program compared to an imaginary group, which merely imagined the movements.

The positive impact of imagery on pain management has been demonstrated in several surveys to show that there is a decrease in pain in the athletes. In the study by Cupal & Brewer, the intervention group experienced significantly less reinjury anxiety and less pain than the placebo and control groups. The calculation of the effect size indicates lasting effects on

psychological and physiological rehabilitation parameters. The study received a Level II score and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 9/10.

Reese et al. (2012) summarized the empirical findings on the effects of psychological interventions in reducing post-injury psychological consequences, and/or improving psychological coping during the injury rehabilitation process among competitive and recreational athletes. The study included randomized control trials (RCTs), non RCTs that utilize a comparison group, before and after study designs, and qualitative methods. The study conducted comprehensive electronic searches and searched the following electronic databases: Academic Search Elite, ERIC, Health Source: Nursing/Academic Edition, PubMed, PsychINFO. A total of 991 relevant articles were identified. Only seven articles met the study inclusion criteria regarding the type of participants, intervention, and outcome measures. The study showed that psychological interventions utilizing guided imagery, goal setting or relaxation are often associated with decreased negative psychological consequences, improved coping, and reduced re-injury anxiety.

The results showed that injured athletes' overall mood was improved after the intervention. The study showed that relaxation can be used to reduce the feelings of depression, frustration, and anger through lowering heart rate, breathing rate, metabolic rate, and blood pressure. The study found that goal setting also led to an increase in self-efficacy and/or self-confidence as a result of accomplishing a set goal during the rehabilitation process. The article concludes that many techniques were discussed in this review are routinely used by professionals. There is an abundant amount of empirical data supporting the use of abovementioned psychological strategies to aid in or enhance athletic performance. The study

received a Level II score and a Grade A on the John Hopkins Evidence Based Model. The CASP score was 9/10.

Christakou et al. (2007) examined the effects of treatment imagery on functional rehabilitation in athletes who sustained an acute grade II ankle sprain. The study hypothesized that the experimental participants who received treatment imagery rehearsal in addition to the physical therapy course would have better muscle endurance, dynamic balance, and functional stability than participants in the control group. The study consisted of 20 volunteer injured athletes (17 men and 3 women) aged from 18 to 30 years old. The following tools were used to assess each athlete: A scoring scale for subjective and functional follow-up evaluation of an ankle sprain, Functional stability tests, and Dynamic Balance. Results revealed that the participants of the experimental group showed better muscular endurance than the control group as this was recorded by the total points achieved on the heel-rise and toe-rise tests. The study also showed that the experimental group had better functional stability performing the single-leg hops for a time test in comparison to the control group. Imagery was found to have a positive effect on the functional stability of neurological patients. The present findings suggested that treatment imagery can have positive effects on the rehabilitation process of injured athletes. According to the findings, imagery may have a positive relationship in the improvement of sport injury rehabilitation process. The study received a Level I score and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 9/10.

Mid-level quality studies on the use of imagery in rehabilitation settings specifically for ACLR

Scherzer et al (2001) study was to examine the relationship between self-reported use of psychological skills and adherence to a sport injury rehabilitation program. There were 54 patients (17 women and 37 men) from an orthopedic physical therapy clinic. The mean age was

28 years and of some mixed origins. The study had 28 participants who were competitive athletes, and 25 were recreational athletes. The goal setting, healing-imagery, and positive-self-talk subscales of the Sports Injury Survey were used to assess the extent of participants' use of psychological skills during rehabilitation. In this study, self-reported goal setting was associated with home and clinic-based measures of adherence. Receiving guidance in acquiring and implementing psychological skills from a sport-injury-rehabilitation professional might help facilitate adherence to the rehabilitation regimen and, ultimately, further enhance the rehabilitation experience of athletes with injuries. Self-reported use of healing imagery was associated with none of the four indices of sport-injury-rehabilitation adherence (attendance, home exercise completion, home cryotherapy completion, and Sport Injury Rehabilitation Adherence Scale). Even though imagery was not associated with adherence, it was found that it may contribute to better recovery from sports injuries. The study received a Level III score due to a correlational design of non-experimental studies and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 7/10.

Lebon et al. (2011) studied to find and assess the therapeutic effects of mental imagery on electromyographic (EMG) activity, functional recovery, range of motion (ROM), effusion resorption, as well as pain management in athletes who have gone through ACLR. The study hypothesized that guided mental imagery training would contribute to improving motor recovery and decreasing pain. There were 12 volunteers (10 men and 2 women) to take part in a motor rehabilitation program. The mental imagery (MI) rehabilitation program ranged from 28 to 34 days with a total of 12 sessions. The sessions were arranged every two days with each session lasting 15 minutes. The results of this study show that muscle activation increased in both groups, but the activity was significantly greater in the MI group. This study demonstrates that

physical therapy combined with MI could better enhance muscle activation following ACL reconstructive surgery. MI might also influence the recovery of muscle activity and can lead to strength gains, which should be considered in rehabilitation settings as a reliable and cost-effective complement. The study received a Level III score and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 7/10.

High-level quality studies on the use of imagery in rehabilitation settings specifically for ACLR

Rodriguez et al. (2019) determined if imagery training in combination with standard physical therapy is a suitable option to reduce the fear of reinjury and pain perception among first-time anterior cruciate ligament reconstruction (ACLR) patients. The search strategy used was graded by the PICO strategy, and used the following sources: PubMed, EBSCOhost, The Conchrane Library, and Google Scholar. The study only found 4 relevant studies. The studies that were appraised have suggested that the fear of reinjury may play a significant role in the patient's ability to return to the same level of activity after surgery. The results of this critically appraised topic support the evidence that imagery can potentially reduce the fear of reinjury and pain in the ACLR population. The article also found that addressing the psychological component during the early stages of recovery has shown to be effective in reducing pain and increasing range of motion. Imagery, in combination with physical therapy, can potentially promote greater activation of the quadriceps muscles and reduce ligamentous laxity, which can promote greater knee function (Rodriguez et al., 2019). The study finds that guided imagery has been shown to be associated with reduction of reinjury anxiety, lowered stress levels, increased muscle activation, and decreased pain perception. The study concludes that ongoing research efforts are needed to examine the benefits of addressing psychological factors affecting injured

athletes. The study received a Level I score and a Grade A on the John Hopkins Evidence Based Model. The CASP score was 9/10.

Maddison et al. (2011) evaluated the effectiveness of a guided imagery intervention to improve functional outcomes post-ACLR and explore potential psychological and psychobiological mechanisms. The primary outcome was knee strength at 6-month post ACLR. Knee strength was assessed with a Cybex 6000 isokinetic dynamometer. Secondary outcomes of the study included knee laxity at 6 months post ACLR. The study consisted of a single blinded, parallel arm randomized-controlled pilot trial and included, 21 participants, who were mostly male. The study resulted in a null effect for knee strength at 6 months post ACLR, but a positive effect on knee laxity. The lack of effect on knee strength is contrary to previous research, which found improvements in knee strength following a similar intervention. The imagery intervention did have a positive effect on knee laxity, which suggests imagery and relaxation are associated with improved healing. The positive effect on the body system was found on both noradrenaline and dopamine levels. Noradrenaline and dopamine levels at 2, 6, and 12 weeks post ACLR were also related to change in knee laxity. The study finds that the stress is associated with marked delays in healing. It was found that the lower the levels of noradrenaline and dopamine the lower the stress and anxiety levels were. The findings suggest that the intervention can improve healing and reduce neurobiological reactions to stress, however due to a small sample size there still needs more research. In conclusion, a guided-imagery intervention improved knee laxity and healing-related neurobiological factors, and mitigated declines in rehabilitation self-efficacy. The study received a Level I score and a Grade B on the John Hopkins Evidence Based Model. The CASP score was 9/10. Pedro scaled a 9/11.

Cupal & Brewer (2001) evaluated the effectiveness of an intervention featuring relaxation and imagery on psychological and physical aspects of rehabilitation following ACLR. The study used both a placebo, standard, and no-treatment control groups. The study hypothesized that participants receiving the intervention would demonstrate greater knee strength, less reinjury anxiety, and less pain than participants receiving placebo treatment or no treatment. Participants recruited were 30 individuals (16 men and 14 women) ranging in age from 18 to 50 years. Knee strength was measured with a Cybex 6000 isokinetic dynamometer, an instrument that assesses concentric-eccentric ligament activity. Participants in the treatment group each received 10 individual sessions of relaxation and guided imagery with physical therapy sessions. Results of the treatment group demonstrated significantly greater knee strength at 24 weeks than placebo group participants and control group. The participants also demonstrated reduced injury anxiety at 24 weeks post-surgery compared to the placebo and control group. Participants in the treatment group also demonstrated reduced pain at 24 weeks post-surgery to a greater extent than participants in the placebo group and control group. The study showed that treatments consisting primarily of relaxation and guided imagery produced significantly greater knee strength and significantly lower levels of reinjury anxiety and pain relative to placebo and control conditions. A major strength of the current study was inclusion of a placebo group to control for nonspecific treatment factors such as attention, caring, and support in addition to a traditional control group. The study received a Level I score and a Grade A on the John Hopkins Evidence Based Model. The CASP score was 9/10. The Pedro graded a 10/11.

Summary

. The articles included in the review all agree with one another on the use of imagery and its effects on athletes. The studies do have inconsistencies in which some agree with imagery

increasing muscle strength and size, while other studies found that they did not. One topic that each study agrees on is that imagery does help in reducing reinjury anxiety. The main study Cupel & Brewer (2001) has been the main basis for all the systematic reviews in this study. The main finding is the decreased anxiety and psychosocial symptoms in injured athletes.

The next chapter will be discussing the review and synthesis of all the articles as well as discussing the implementation into practice. As well as synthesizing all the literature to answer practical questions, identify current trends in literature, identify implication for athletic training practice, talk about recommendations in the future and give the final thoughts on the use of imagery in rehabilitation.

Chapter 4: Discussion, Implementation, Conclusion

Literature Synthesis

Psychological factors are being increasingly recognized as an important role in return to play status after ACLR (Nwachukwu et al., 2019). Using a comprehensive search strategy, this study aimed to determine a need for psychological interventions, mainly imagery, on ACLR patient populations. This review of mental imagery rehabilitation illustrates a significant lack of well-designed imagery studies targeting this population. Nwachukwu et al. (2019) reported that of all athletes who return to play, only 63.4% of players returned to play at the competitive sport level. In addition, 36.6% of players did not return to their previous level of play. A similar study by Arden et al. (2014) found that only 50% of players returned to their preinjury sport or recreational activity after ACLR.

Webster et al. (2018) found that return to sport status was suggested to be composed of three key aspects: confidence in returning to the sport, realistic expectations of sport capability, and motivation to regain preinjury performance standards. An athlete's confidence in their ability to perform at the same preinjury level was associated with a better return to play status readiness. Webster et al. (2018) also reported that the fear of reinjury was the primary reason for an athlete not returning to sport or returning, but not at the same level of play. The study by Webster et al. (2018) supports the research completed by Nwachukwu et al. (2019) as they explain that fear of reinjury was the most commonly reported psychological factor in determining if an athlete will return to play after ACLR. Webster et al. (2018) suggest that fear of reinjury may not be the most appropriate term to describe the emotional response of the athlete. Instead, they suggest that using the term "reinjury anxiety" can help describe what the athlete is really feeling. "As fear is a stimulus-specific biological mechanism, whereas anxiety is associated with anticipation or

uncertainty" (p. 7); this helps to explain that the athlete's level of anxiety is determined by reinjury anticipation.

Reinjury anxiety can lead to depression symptoms, which may lead to a decrease in return to play (Garcia et al., 2015). Garcia et al. (2015) also reported that two out of every five patients who received ACLR report depression symptoms, which seem to correlate with lower self-reported functional scores at baseline and one year after surgery. This may be due to the lack of psychological therapeutic intervention education during rehabilitation. This review was aimed to determine if imagery can decrease psychological symptoms (fear of reinjury/reinjury anxiety) and increase the rate of return to play.

Imagery is defined in *Psychosocial Strategies for Athletic Training* (Granquist et al., 2015) as the creation or re-creation of an experience from the imager and may occur without the stimulus "injury" associated with the experience. The practice of imagining an experience without physically completing the task increases the ability to mentally prepare for the return to play. During an imagery intervention, injured athletes are asked to imagine a scenario related to the injury recovery status, whether it be the healing stage of the injury or during the rehabilitation stage. They may be prompted to imagine the process of their rehabilitation, and progress during each of the rehabilitation phases. The emotions they may experience, as well as the successful completion and return to full sports engagement after completing the rehabilitation process (Reese et al., 2012).

Cupal et al. (2001) found that a treatment consisting of primary relaxation and guided imagery produced greater knee strength, significantly lower levels of reinjury anxiety, and lower pain levels compared to the placebo/control group. A major strength of this study is that they included a placebo group. This allowed the researchers to see the differences and the effect of the

intervention. Multhaup et al. (2018), Reese et al. (2012), Maddison et al. (2011), Christakou et al. (2007) and Rodriguez et al. (2019) all found similar results, as they found that imagery helped to reduce reinjury anxiety, improve coping, and decrease negative psychological consequences. This research supports the idea that imagery is beneficial with rehabilitation techniques to reduce psychological symptoms.

Multhaup et al. (2018) reported a significant finding in that the intervention group (relaxation and imagery) reported having a positive attitude towards rehabilitation. This may yield to better retention in rehabilitation and provide a better outcome for the athletes. While Maddison et al. (2011) found a positive effect on reducing noradrenaline and dopamine in athletes who used mental imagery. Noradrenaline and dopamine are associated with high-stress levels in patient populations, thus a decrease in these can help to decrease stress and anxiety. Rodregiuez et al. (2019) also found that there was a reduction of neurobiological factors associated with anxiety and stress while utilizing imagery. These findings are significant due to the fact that stress hormones delay the healing process.

Monsma et al. (2009) and Law et al. (2006) also reported similar findings in that imagery use was associated with better coping and decreased levels of anxiety. Monsma et al. (2009) found that "imagery use and confidence in returning to one's previous ability were more important in predicting anxiety about return to play than days of rehabilitation" (p. 416). They also found that arousal imagery and the excitement of imagery used in rehabilitation can increase anxiety and be detrimental to the rehabilitation process. It was also reported that the longer the athlete was injured, the less likely they used imagery and were more likely to experience an increase in anxiety. This means that health care professionals should let the athlete understand the effects of using imagery and which images they should be utilizing. Law et al. (2006) found

that the use of imagery was associated with an enhanced satisfaction with the rehabilitation experience. As stated, it can lead to an enhanced rehabilitation program with better outcomes. The only issue with these studies is the design, as the studies are cohort studies and had lower quality control measures.

Trends in Gaps in Literature

This critical review allowed for the identification of trends regarding research around the topic of imagery and rehabilitation. Anxiety, specifically re injury anxiety, is the main symptom that athletes reported as the main predictor in determining their return to play. Most of the reviewed studies point to the use of imagery in decreasing anxiety in the athlete during their rehabilitation. Imagery also helps to decrease the time to return to play status. A current gap in the literature would be differences in gender and attempting to determine, if the use of imagery is as efficient in men as is in women. Due to a decrease in anxiety levels, another gap seen is regarding differences from different professional sport settings.

Implications for Athletic Training Practice

The use of imagery has been found to decrease anxiety levels and decrease return to play status in rehabilitation settings. Participants who used imagery also were found to have better overall satisfaction with rehabilitation. This leads to a better retention rate, meaning athletes will want to continue to pursue their rehab program to overall return to the sport. Taking into consideration that athletes report re-injury anxiety in their ability to return in competitive and recreational sports, implementing imagery techniques in athletic training settings may help to alleviate these factors. Imagery can potentially reduce anxiety and pain in the rehabilitation setting. The results suggest that athletic trainers can enhance the recovery of individuals who

have had ACL reconstructive surgery by providing strategic interventions that go beyond nonspecific support.

Recommendations for Future Research

As a result of this critical review of the literature, it is clear that there has been a limited amount of research done on the use of imagery in ACLR populations. The currently available literature focused on different injuries and not solely focused on the ACLR population. In addition to there being a lack of available research, another limitation is the limited sample size included in the previous research. Many of the randomized control trials that were evaluated in this literature review had sample sizes of 30 or below. Even though the available research studies utilized high effect size samples, it is still considered a limited sample size as it may not correlate with the intended population. One recommendation would be to investigate if there is a difference in social class setting. Murphy (1991) found that those in lower socio-economic settings had higher anxiety as well as stress levels. Will imagery work just as well in middle class settings compared to lower class settings, as they all have different anxiety levels due to their social class setting (Murphy, 1991).

Conclusion

In conclusion, the results show that imagery can be useful in decreasing anxiety levels as well as increased return to play level. Anxiety is the number one predictor in return to play status for as reported by athletes (Nwachukwu et al., 2019). Imagery was found to be helpful and achieve better return to play status. Imagery has been shown to be associated with reduction of reinjury anxiety, lowered stress levels, potential increased muscle activation, and potential decreased pain perception. This rehabilitation intervention helped to have a better satisfaction

rating among athletes in rehabilitation, which can lead to increased retention in rehabilitation. The study provides further support for the use of mental imagery interventions to enhance both psychological and physical aspects of sport injury rehabilitation. The results suggest that health care professionals can enhance the recovery of individuals who have had ACL reconstructive surgery through imagery implementation. The biggest limitation is the limited studies found specifically for ACLR patients. Therefore, ongoing research efforts are needed to examine the benefits of addressing imagery specifically for the ACLR population.

References

Ardern, C. L., Taylor, N. F., Feller, J. A., Whitehead, T. S., & Webster, K. E. (2013). Psychological Responses Matter in Returning to Preinjury Level of Sport After Anterior Cruciate Ligament Reconstruction Surgery. *The American Journal of Sports Medicine*, *41*(7), 1549–1558. doi: 10.1177/0363546513489284

Ardern, C. L., Österberg, A., Tagesson, S., Gauffin, H., Webster, K. E., & Kvist, J. (2014). The impact of psychological readiness to return to sport and recreational activities after anterior cruciate ligament reconstruction. *British Journal of Sports Medicine, 48*(22), 1613-1619. doi:10.1136/bjsports-2014-093842

Ardern, C. L., Taylor, N. F., Feller, J. A., Whitehead, T. S., & Webster, K. E. (2015). Sports Participation 2 Years After Anterior Cruciate Ligament Reconstruction in Athletes Who Had Not Returned to Sport at 1 Year. *The American Journal of Sports Medicine*, *43*(4), 848–856. doi: 10.1177/0363546514563282

Christakou, A., Zervas, Y., & Lavallee, D. (2007). The adjunctive role of imagery on the functional rehabilitation of a grade II ankle sprain. *Human Movement Science, 26*(1), 141–154. doi: 10.1016/j.humov.2006.07.010

Coronado, R. A., Bird, M. L., Hoy, E. E. V., Huston, L. J., Spindler, K. P., & Archer, K. R. (2017). Do psychosocial interventions improve rehabilitation outcomes after anterior cruciate ligament reconstruction? A systematic review. Clinical Rehabilitation, 32(3), 287–298. doi: 10.1177/0269215517728562

Cupal, D. D., & Brewer, B. W. (2001). Effects of relaxation and guided imagery on knee strength, reinjury anxiety, and pain following anterior cruciate ligament reconstruction. *Rehabilitation Psychology, 46*(1), 28–43. doi: 10.1037/0090-5550.46.1.28

Garcia, G. H., Wu, H.-H., Park, M. J., Tjoumakaris, F. P., Tucker, B. S., Kelly, J. D., & Sennett, B. J. (2015). Depression Symptomatology and Anterior Cruciate Ligament Injury. *The American Journal of Sports Medicine*, *44*(3), 572–579. doi: 10.1177/0363546515612466

Granquist, M. D., Hamsom-Utley, J. J., Kenow, L. J., & Stiller-Ostrowski, J. (2015). *Psychosocial strategies for athletic training*. Philadelphia: F.A. Davis Company.

Hsu, C.-J., Meierbachtol, A., George, S. Z., & Chmielewski, T. L. (2016). Fear of Reinjury in Athletes. *Sports Health: A Multidisciplinary Approach, 9*(2), 162–167. doi: 10.1177/1941738116666813

Law, Barbi & Ma, Molly & Driediger, Molly & Ma, Craig & Hall, Lorie & Forwell, Msc. (2006). Imagery use, perceived pain, limb functioning and satisfaction in athletic injury rehabilitation. *New Zealand Journal of Physiotherapy. 34*. 10-16.

Lebon, F., Guillot, A., & Collet, C. (2011). Increased Muscle Activation Following Motor Imagery During the Rehabilitation of the Anterior Cruciate Ligament. *Applied Psychophysiology and Biofeedback*, *37*(1), 45–51. doi: 10.1007/s10484-011-9175-9

Ling, D., Chiaia, T., Mille, P. D., & Robert, M. (2018). The psychological impact of return to sport testing after anterior cruciate ligament reconstruction: A randomized controlled

trial. *Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology*, *13*. doi: https://doi.org/10.1016/j.asmart.2018.06.066

Maddison, R., Prapavessis, H., Clatworthy, M., Hall, C., Foley, L., Harper, T., … Brewer, B. (2011). Guided imagery to improve functional outcomes post-anterior cruciate ligament repair: randomized-controlled pilot trial. *Scandinavian Journal of Medicine & Science in Sports*, *22*(6), 816–821. doi: 10.1111/j.1600-0838.2011.01325.x

Mcpherson, A. L., Feller, J. A., Hewett, T. E., & Webster, K. E. (2019). Psychological Readiness to Return to Sport Is Associated With Second Anterior Cruciate Ligament Injuries. *The American Journal of Sports Medicine, 47*(4), 857–862. doi: 10.1177/0363546518825258

Mcveigh, F., & Pack, S. M. (2015). An Exploration of Sports Rehabilitators' and Athletic Rehabilitation Therapists' Views on Fear of Reinjury After Anterior Cruciate Ligament Reconstruction. *Journal of Sport Rehabilitation*, *24*(2), 140–150. doi: 10.1123/jsr.2014-0127

Monsma, E., Mensch, J., & Farroll, J. (2009). Keeping Your Head in the Game: Sport-Specific Imagery and Anxiety Among Injured Athletes. *Journal of Athletic Training*, *44*(4), 410–417. doi: 10.4085/1062-6050-44.4.410

Multhaupt, G., & Beuth, J. (2018). The use of imagery in athletic injury rehabilitation. A systematic review. *Deutsche Zeitschrift Für Sportmedizin*, *2018*(03), 57–64. doi: 10.5960/dzsm.2018.316

Murphy, J. M. (1991). Depression and Anxiety in Relation to Social Status. *Archives of General Psychiatry,* 48(3), 223. doi: 10.1001/archpsyc.1991.01810270035004

Nursing - Evidence-Based Practice: Johns Hopkins Nursing EBP. (n.d.). Retrieved from https://libguides.daemen.edu/c.php?g=704212&p=4999155.

Nwachukwu, B. U., Adjei, J., Rauck, R. C., Chahla, J., Okoroha, K. R., Verma, N. N., . . . Williams, R. J. (2019). How Much Do Psychological Factors Affect Lack of Return to Play After Anterior Cruciate Ligament Reconstruction? A Systematic Review. Orthopaedic Journal of Sports Medicine, 7(5), 232596711984531. doi:10.1177/2325967119845313

PEDro scale (English). (n.d.). Retrieved from https://www.pedro.org.au/english/downloads/pedro-scale/

Petrie, T. A. (1993). Coping skills, competitive trait anxiety, and playing status: Moderating effects on the life stress-injury relationship. *Journal of Sport & Exercise Psychology, 15*(3), 261–274.https://doi.org/10.1037/a0032698

Reese, L. M. S., Pittsinger, R., & Yang, J. (2012). Effectiveness of psychological intervention following sport injury. *Journal of Sport and Health Science, 1*(2), 71–79. doi: 10.1016/j.jshs.2012.06.003

Raab, S., & Craig, D. I. (2016). *Evidence-based practice in athletic training.* Champaign, IL: Human Kinetics.

Rodriguez, R. M., Marroquin, A., & Cosby, N. (2019). Reducing Fear of Reinjury and Pain Perception in Athletes With First-Time Anterior Cruciate Ligament Reconstructions by

Implementing Imagery Training. *Journal of Sport Rehabilitation, 28*(4), 385–389. doi: 10.1123/jsr.2017-0056

Trigsted, S. M., Cook, D. B., Pickett, K. A., Cadmus-Bertram, L., Dunn, W. R., & Bell, D. R. (2018). Greater fear of reinjure is related to stiffened jump-landing biomechanics and muscle activation in women after ACL reconstruction. *Knee Surgery, Sports Traumatology, Arthroscopy*, *26*(12), 3682–3689. doi: 10.1007/s00167-018-4950-2

Webster, K. E., Nagelli, C. V., & Hewett, T. E. (2018). Factors Associated With Psychological Readiness to Return to Sport After Anterior Cruciate Ligament Reconstruction Surgery. *The American Journal of Sports Medicine*, *46*(7), 1545–1550. doi: https://doi-org.ezproxy.bethel.edu/10.1177/0363546518773757

Appendix

Table 1: Matrix

<table>
<tr><td colspan="5">Source: Ardern, C. L., Österberg, A., Tagesson, S., Gauffin, H., Webster, K. E., & Kvist, J. (2014). The impact of psychological readiness to return to sport and recreational activities after anterior cruciate ligament reconstruction. British Journal of Sports Medicine, 48(22), 1613-1619. doi:10.1136/bjsports-2014-093842</td></tr>
<tr><td rowspan="2">Purpose: The purpose of this study was aimed to examine whether appraisal of knee function, psychological, and demographic factors were related to return to play after ACL reconstruction</td><td>Sample: 164 participants who had undergone ACLR</td><td>Measurements: Questionnaires evaluating knee self-efficacy, health locus of control and psychological readiness on RTP</td><td>Results: Less than 50% returned to their preinjury sport after ACLR. Psychological readiness was a major factor associating to RTP</td><td rowspan="2">Level/Quality:

Level III
Grade B</td></tr>
<tr><td>Design: Cross-Sectional Study</td><td colspan="2">Recommendation: This article helps us to identify why less than 50% return to play, as psychological readiness played a major role</td></tr>
<tr><td colspan="5">Source: Webster, K. E., Nagelli, C. V., & Hewett, T. E. (2018). Factors Associated With Psychological Readiness to Return to Sport After Anterior Cruciate Ligament Reconstruction Surgery. The American Journal of Sports Medicine, 46(7), 1545–1550. doi: https://doi-org.ezproxy.bethel.edu/10.1177/0363546518773757</td></tr>
<tr><td rowspan="2">Purpose: The purpose was to find factors that contribute to an athlete's psychological readiness to return to sport after ACLR</td><td>Sample: 635 Athletes (389 males, 246 Female)</td><td>Measurements: ACL-RSI Scores</td><td>Results: Self-reported symptoms and functions were associated with psychological readiness. Males had higher psychological readiness, while females had more negative outlook. Females may benefit interventions more than males</td><td rowspan="2">Level/Qualit:

Level III
Grade B</td></tr>
<tr><td>Design: Cross-Sectional Study</td><td colspan="2">Recommendation: Symptoms reported are associated with psychological readiness to RTP and should be addressed. Females may benefit more from interventions of imagery</td></tr>
<tr><td colspan="5">Source: Garcia, G. H., Wu, H.-H., Park, M. J., Tjoumakaris, F. P., Tucker, B. S., Kelly, J. D., & Sennett, B. J. (2015). Depression Symptomatology and Anterior Cruciate Ligament Injury. The American Journal of Sports Medicine, 44(3), 572–579. doi: 10.1177/0363546515612466</td></tr>
</table>

<table>
<tr><td rowspan="2">Purpose: The purpose of this study was to quantify the number of major depressive disorder cases and to correlate depression symptoms with knee function in patients undergoing ACLR</td><td>Sample:
64 Adult patients undergoing ACLR</td><td>Measurements:
Quick inventory of depressive symptomatology</td><td>Results:
2 out of every 5 patients undergoing ACLR may report depression symptoms. Depression correlates with lower self-reported functional scores at 1 year post op. This suggests that difference in perception may affect athletic ability and RTP</td><td rowspan="2">Level/Quality:

Level III
Grade B</td></tr>
<tr><td>Design:
Cohort Study</td><td colspan="2">Recommendation: Perception is a big factor in RTP. We should address this in the athletes' practice setting to give the athletes a better perception and RTP</td></tr>
<tr><td colspan="5">Source: Mcpherson, A. L., Feller, J. A., Hewett, T. E., & Webster, K. E. (2019). Psychological Readiness to Return to Sport Is Associated With Second Anterior Cruciate Ligament Injuries. The American Journal of Sports Medicine, 47(4), 857–862. doi: 10.1177/0363546518825258</td></tr>
<tr><td rowspan="2">Purpose: The purpose was to determine whether psychological readiness to return to sport is associated with second ACL injury.</td><td>Sample:
329 Patients who had ACLR</td><td>Measurements:
ACL-RSI Scores vs Second injury rate</td><td>Results:
Younger patients with lower psychological readiness are at a higher risk for second ACL injury after RTP</td><td rowspan="2">Level/Quality:

Level III

Grade B</td></tr>
<tr><td>Design:
Cohort Study</td><td colspan="2">Recommendation: ACL rerupture is a big problem for ACLR patients as they have increased fear of reinjury. We can understand that psychological readiness is a factor in decreasing secondary rupture</td></tr>
<tr><td colspan="5">Source: Trigsted, S. M., Cook, D. B., Pickett, K. A., Cadmus-Bertram, L., Dunn, W. R., & Bell, D. R. (2018). Greater fear of reinjure is related to stiffened jump-landing biomechanics and muscle activation in women after ACL reconstruction. Knee Surgery, Sports Traumatology, Arthroscopy, 26(12), 3682–3689. doi: 10.1007/s00167-018-4950-2</td></tr>
<tr><td>Purpose: The purpose was to investigate the relationship between fear of reinjury and jump-landing biomechanics</td><td>Sample:
36 Females</td><td>Measurements:
Jumping mechanics 3d capture</td><td>Results:
A higher amount of fear of reinjury is associated with stiffened movement patterns. Clinicians should evaluate psychological and emotional consequences of injury.</td><td>Level/Quality:

Level III

Grade B</td></tr>
</table>

	Design: Cohort Study	**Recommendation:** Stiffness is associated with a higher amount of fear of reinjury which can cause secondary rupture. We must evaluate the readiness of the patient before RTP		
Source: Ling, D., Chiaia, T., Mille, P. D., & Robert, M. (2018). The psychological impact of return to sport testing after anterior cruciate ligament reconstruction: A randomized controlled trial. *Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology*, *13*. doi: https://doi.org/10.1016/j.asmart.2018.06.066				
Purpose:The purpose was to evaluate a return to sport testing program on psychological readiness after ACLR	**Sample**: 30 athletes who had ACLR	**Measurements**: Quality of Movement Assessment (QMA)	**Results:** QMA limited effect on psychological response may be due to athlete's self-awareness of physical deficits at 6 months post op. Provides understanding of factors that contributed to the injury.	**Level/Quality:** Level I Grade B
	Design: Randomized Control Trial	**Recommendation:** Imagery can help to boost athlete's perceptions after ACLR to keep them in a positive state to return to play.		
Source: Nwachukwu, B. U., Adjei, J., Rauck, R. C., Chahla, J., Okoroha, K. R., Verma, N. N., . . . Williams, R. J. (2019). How Much Do Psychological Factors Affect Lack of Return to Play After Anterior Cruciate Ligament Reconstruction? A Systematic Review. *Orthopaedic Journal of Sports Medicine, 7*(5), 232596711984531. doi:10.1177/2325967119845313				
Purpose: The purpose of this study was (1) to evaluate available studies relating to the psychological factors on RTP after ACLR, (2) to identify any factors affecting RTP after ACLR, and (3) to understand currently available metrics	**Sample**: 19 studies with 2175 patients	**Measurements**: N/A	**Results:** Psychological factors play an important role in RTP after ACLR. There was a delay in returning as well as lower RTP rates compared with previous literature. Fear of reinjury was most commonly reported.	**Level/Quality:** Level III Grade B

used to assess psychological RTP readiness	**Design:** Systematic review	**Recommendation:** This study can help to understand what psychological factors are affecting athletes after ACLR. We can utilize this and be able to achieve better RTP for athletes		
Source: Monsma, E., Mensch, J., & Farroll, J. (2009). Keeping Your Head in the Game: Sport-Specific Imagery and Anxiety Among Injured Athletes. *Journal of Athletic Training*, *44*(4), 410–417. doi: 10.4085/1062-6050-44.4.410				
Purpose: The purpose was to explore images used during rehabilitation and to examine athlete injury characteristic in relation to the use of imagery and RTP anxiety. The study also compared the frequency of imagery used in early rehab, and the relationship between RTP and anxiety.	**Sample**: 36 injured D1 athletes sustaining at least an 8 day injury suspension	**Measurements**: Sport Imagery Questionnaire, Sport Anxiety Scale	**Results:** . The results were inconsistent and conflicting. In the end there were no conclusive results.	**Level/Quality:** Level III Grade B
	Design: Observationl Design	**Recommendation:** This study can help to show that there is a need for psychosocial studies. It identifies this issue such as a fear of re-injury and the need to find the best strategy in helping the athletes cope with an injury and return to play.		
Source: Coronado, R. A., Bird, M. L., Hoy, E. E. V., Huston, L. J., Spindler, K. P., & Archer, K. R. (2017). Do psychosocial interventions improve rehabilitation outcomes after anterior cruciate ligament reconstruction? A systematic review. Clinical Rehabilitation, 32(3), 287–298. doi: 10.1177/0269215517728562				
Purpose: The purpose of this study was to examine if psychosocial interventions can improve patient reported outcome to return to sport after ACLR	**Sample**: 893 Articles	**Measurements**: Physiotherapy Evidence Database Scale	**Results:** Overall, there is limited evidence on the efficacy of postoperative psychosocial interventions for improving functional recovery after ACLRn.	**Level/Quality:** Level II Grade A
	Design: Systematic Review	**Recommendation:** No recommendations as there is limited evidence that proves that imagery can help in decreasing perception or help with recovery.		
Source: Law, Barbi & Ma, Molly & Driediger, Molly & Ma, Craig & Hall, Lorie & Forwell, Msc. (2006). Imagery use, perceived pain, limb functioning and satisfaction in athletic injury rehabilitation. *New Zealand Journal of Physiotherapy. 34*. 10-16.				
Purpose: The purpose of the study was to examine the relationship between imagery use, perceived pain, overall lower limb functioning, and satisfaction of rehab	**Sample**: 83 injured athletes	**Measurements**: Athletic Injury Imagery Questionnaire -2 (AIIQ-2)	**Results:** Imagery did not yield to better results regarding a decrease in pain, however it did yield results in increased satisfaction with rehabilitation.	**Level/Quality:** Level III Grade B

	Design: Cross-Sectional	**Recommendation:** Even though imagery did not produce positive results, it did help psychologically in having a better rehabilitation satisfaction. This could help to decrease anxiety and lower fear of reinjury.		
Source: Sordoni, C., Hall, C., & Forwell, L. (2000). The Use of Imagery by Athletes during Injury Rehabilitation. *Journal of Sport Rehabilitation*, *9*(4), 329–338. doi: 10.1123/jsr.9.4.329				
Purpose: The purpose of this study was to determine whether athletes use motivational or cognitive imagery during rehabilitation	**Sample**: 71 injured athletes	**Measurements**: Athletic injury imagery questionnaire	**Results:** Motivational imagery was used more often when compared to cognitive imagery. AIIQ is a good tool to be used to examine athletes use of imagery in rehab	**Level/Quality:** Level III Grade B
	Design: Survey research	**Recommendation:** AIIQ can be a useful tool to utilize in rehab settings to help associate and familiarize athletes in the use of imagery.		
Source: Veraksa, A., & Gorovaya, A. (2012). Imagery training efficacy among novice soccer players. *Procedia - Social and Behavioral Sciences*, *33*, 338–342. doi: 10.1016/j.sbspro.2012.01.139				
Purpose: The purpose of this study was to investigate specificity of imagery use by youth athletes and to establish efficacy of imagery training on performance	**Sample**: 41 soccer players	**Measurements**: Sport imagery questionnaire	**Results:** Soccer players used both cognitive and motivational imagery. Beginner players used more motivational imagery and only later started to use cognitive imagery. The use of the imagery training program led to an increase in sports performance.	**Level/Quality:** Level II Grade B
	Design: Survey research	**Recommendation:**. Imagery was found useful in the results of sports performance, which can be useful in determining the usefulness of imagery in a rehabilitation setting.		
Source: Multhaupt, G., & Beuth, J. (2018). The use of imagery in athletic injury rehabilitation. A systematic review. *Deutsche Zeitschrift Für Sportmedizin*, *2018*(03), 57–64. doi: 10.5960/dzsm.2018.316				
Purpose: The purpose of the study was to provide a systematic review of current studies on the use of imagery in rehabilitation settings	**Sample**: 9 studies used (126 patients total)	**Measurements**: N/A	**Results:** Imagery contributed to remission of reinjury anxiety, perceived pain, and decreased fear of reinjury.	**Level/Quality:** Level II Grade A

	Design: Systematic review	**Recommendation:** Imagery contributed to positive effects, however this leads to the need for higher quality studies regarding this topic.		
Source: Reese, L. M. S., Pittsinger, R., & Yang, J. (2012). Effectiveness of psychological intervention following sport injury. *Journal of Sport and Health Science, 1*(2), 71–79. doi: 10.1016/j.jshs.2012.06.003				
Purpose: The purpose of this study was to summarize the findings of the effects of psychological interventions in reducing post injury psychological consequences.	**Sample**: 6 studies	**Measurements**: N/A	**Results:** Results support the effectiveness of psychological interventions in reducing post-injury psychological consequences. Mainly imagery was shown to improve coping skills and reduce re-injury anxiety. Goal setting was not associated with any positive results.	**Level/Quality:** Level II Grade A
	Design: Systematic Review	**Recommendation:** Imagery yielded positive results in reducing anxiety with increased coping. Can help in rehabilitation settings.		
Source: Christakou, A., Zervas, Y., & Lavallee, D. (2007). The adjunctive role of imagery on the functional rehabilitation of a grade II ankle sprain. *Human Movement Science, 26*(1), 141–154. doi: 10.1016/j.humov.2006.07.010				
Purpose: The purpose of this study was to find the effectiveness of imagery on muscular endurance, dynamic balance, and functional stability	**Sample**: 20 active athletes randomly divided	**Measurements**: Score scaled determined by functional and dynamic stability	**Results:** Experimental group found to show better muscular endurance,overall balance, and functional stability	**Level/Quality:** Level I Grade B
	Design: Random Control Trial	**Recommendation:** Imagery should be used in rehabilitation settings and can assist in rehabilitation protocols.		

<table>
<tr><td colspan="5">Source: Scherzer, C. B., Brewer, B. W., Cornelius, A. E., Van Raalte, J. L., Petitpas, A. J., Sklar, J. H., Pohlman, M. H., Krushell, R. J., & Ditmar, T. D. (2001). Psychological Skills and Adherence to Rehabilitation after Reconstruction of the Anterior Cruciate Ligament, Journal of Sport Rehabilitation, 10(3), 165-172. Retrieved Feb 23, 2020, from https://journals.humankinetics.com/view/journals/jsr/10/3/article-p165.xml</td></tr>
<tr><td rowspan="2">Purpose: The purpose of the study was to examine the relationship between self-reported use of psychological skills and adherence</td><td>Sample:
54 (17 women, 37 men)</td><td>Measurements:
Sports injury Survey</td><td>Results:
Goal setting was positively correlated with at home adherence, as well as self-talk. Imagery contributed to better recovery.</td><td>Level/Quality:

Level III

Grade B</td></tr>
<tr><td>Design:
Prospective correlational design</td><td colspan="2">Recommendation:. While goal setting and self talk had better adherence rates, imagery contributed to a better recovery for athletes. Imagery is useful in helping the recovery stage for rehabilitation.</td><td></td></tr>
<tr><td colspan="5">Source: Lebon, F., Guillot, A., & Collet, C. (2011). Increased Muscle Activation Following Motor Imagery During the Rehabilitation of the Anterior Cruciate Ligament. Applied Psychophysiology and Biofeedback, 37(1), 45–51. doi: 10.1007/s10484-011-9175-9</td></tr>
<tr><td rowspan="2">Purpose: The purpose of this study was to assess the therapeutic effects of mental imagery on electromyographic activity, functional recovery, ROM, pain management, in athletes who had gone through ACLR</td><td>Sample:
12 Patients with ACLR</td><td>Measurements:
EMG reading, Motor ability, Anthropometrical data</td><td>Results:
The study concluded that MI could better enhance muscle activation and influence the recovery of muscle activity. MI should be considered a reliable complement to improve the functional rehabilitation for the athlete. This should be used in the early process</td><td>Level/Quality:

Level III
Grade B</td></tr>
<tr><td>Design:
Cohort Study</td><td colspan="2">Recommendation: By utilizing mental imagery, it can help to improve the patients return to play ability. This can decrease anxiety and increase the motivation for the athletes to continue playing.</td><td></td></tr>
<tr><td colspan="5">Source: Rodriguez, R. M., Marroquin, A., & Cosby, N. (2019). Reducing Fear of Reinjury and Pain Perception in Athletes With First-Time Anterior Cruciate Ligament Reconstructions by Implementing Imagery Training. Journal of Sport Rehabilitation, 28(4), 385–389. doi: 10.1123/jsr.2017-0056</td></tr>
<tr><td rowspan="2">Purpose:
The purpose was to look at first time ACLR patients and find if imagery training in combination with standard PT can reduce fear of injury and pain perception</td><td>Sample:
4 relevant studies</td><td>Measurements:
N/A</td><td>Results:
Based on the studies and the strengths, they found that imagery in combination with PT can be effective in reducing psychological distress such as fear of reinjury and pain perception in first time ACLR patients.</td><td>Level/Quality:

Level I
Grade A</td></tr>
<tr><td>Design:
Systematic Review</td><td colspan="2">Recommendation: This can be helpful in being conclusive on how imagery can be beneficial to patients in reducing fear of injury and increasing RTP status in athletes</td><td></td></tr>
</table>

<table>
<tr><td colspan="5">Source: Maddison, R., Prapavessis, H., Clatworthy, M., Hall, C., Foley, L., Harper, T., … Brewer, B. (2011). Guided imagery to improve functional outcomes post-anterior cruciate ligament repair: randomized-controlled pilot trial. Scandinavian Journal of Medicine & Science in Sports, 22(6), 816–821. doi: 10.1111/j.1600-0838.2011.01325.x</td></tr>
<tr><td rowspan="2">Purpose: The aim of the study was to evaluate the effectiveness of imagery intervention to improve functional outcomes post ACLR</td><td>Sample:
21 participants</td><td>Measurements:
Knee strength at 6 months post ACLR</td><td>Results:
The study found that there was a significant effect found for knee laxity and favored the intervention. The intervention was found to improve overall knee laxity and healing related factors post ACLR</td><td rowspan="2">Level/Quality:

Level I
Grade B</td></tr>
<tr><td>Design:
RCT</td><td colspan="2">Recommendation: MI can be found to improve functional outcomes and can be used in the rehabilitation stages. This helps to give a stronger relationship in mental imagery and decreased psychosocial factors after ACLR</td></tr>
<tr><td colspan="5">Source: Cupal, D. D., & Brewer, B. W. (2001). Effects of relaxation and guided imagery on knee strength, reinjury anxiety, and pain following anterior cruciate ligament reconstruction. Rehabilitation Psychology, 46(1), 28–43. doi: 10.1037/0090-5550.46.1.28</td></tr>
<tr><td rowspan="2">Purpose: The purpose of the study was to evaluate the effectiveness of an intervention featuring relaxation and imagery on psychological and physical aspects of rehab following ACLR</td><td>Sample:
30 subjects (16 men, 14 women)</td><td>Measurements:
Re-injury anxiety scale
Cybex 6000 isokinetic dynamometer</td><td>Results:
A treatment that consists of relaxation and guided imagery produced significant knee strength and lower levels of re-injury anxiety and pain compared to the placebo group.</td><td rowspan="2">Level/Quality:

Level I

Grade B</td></tr>
<tr><td>Design:
RCT</td><td colspan="2">Recommendation: Major finding in this study helps to provide information that imagery is useful and helps in decreasing performance anxiety</td></tr>
</table>