

A Narrative Literature Review of the
Psychological Hindrances Affecting Return to Sport After Injuries

Submitted by
Ashley Sweeney

Psychology

To
The Honors College
Oakland University

In partial fulfillment of the
requirement to graduate from
The Honors College

Mentor: Dr. Suzan Kamel-ElSayed
Associate Professor in the Department of Foundational Medical Studies in the Oakland
University William Beaumont (OUWB) School of Medicine
Oakland University

Co-mentor: Stephanie M. Swanberg. MSI, AHIP
Associate Professor, Information Literacy & eLearning Librarian,
Department of Foundational Medical Studies
Oakland University William Beaumont (OUWB) School of Medicine
Oakland University

April 30, 2020

Abstract

After different sport injuries, athletes may express different psychological emotions that lead to stress. These emotions include anger, fear, frustration, anxiety and depression which may lead to lack of confidence and/or fear of sustaining a new injury. This thesis, in the form of a narrative review, aims to focus on the psychological hindrances that can be present when the athlete is planning on returning to the sport after injury to an anterior cruciate ligament (ACL) or concussion. The review will summarize the shared common and the different psychological hindrances that may be found in athletes after an ACL injury or concussion. A generation of a list for such hindrances will educate others about the psychological barriers which may affect the injured athletes from returning to sport.

Introduction

Sports have become an ever-dominant presence in our lives with many people choosing to play sports at the high school, collegiate, professional or recreational level. Being involved in sports comes with the increased chance of injury, especially anterior cruciate ligament (ACL) injuries and sports related concussions.

ACL injuries are one of the most common sports related injuries in the United States with roughly 130,000 reconstructions performed by doctors annually (Kim, Bosque, Meehan, Jamali, & Marder, 2011). The bones of the knee joint are supported by four different ligaments both inside and outside of the knee. On the outside of the knee, there are the collateral ligaments. In the inside of the knee, there is the anterior cruciate ligament (ACL) and the posterior cruciate ligament (PCL), which cross overtop one another. The ACL is in place to provide overall stability to the knee to ensure that the tendons do not move out of place (Irrgang, 1993).

However, when that stability is hindered by a cutting or jerking motion in sports, that is when the tearing of those ligaments often takes place.

Many athletes that sustain these ACL injuries often undergo some type of rehabilitation, most likely physical therapy, but sometimes this rehabilitation may come with a risk. Research suggests that 50% of patients that undergo ACL reconstruction may not be able to reach their previous level of sport, prior to that injury (Ardern, Taylor, Feller, & Webster, 2012; Ardern, Taylor, Feller, & Webster, 2014). Rehabilitation and reconstruction on its own may not be the culprit for why an athlete may not be able to return to their previous level of competition, as there are many other factors that could be affecting the athlete. They could be related to physical factors, such as impairments they may feel they have after sustaining their injury; contextual factors such as social and environmental pressures, as well as their own psychological hindrances they may be experiencing (Ardern, 2015). These factors are not universal as one athlete may experience these factors after undergoing the surgery and not be able to return to their previous level of sport. On the other hand, another athlete may have undergone the same procedures but still be able to return to their previous level of competition.

Concussions pose another threat to the athlete, as this injury has many hidden symptoms and signs, unlike how an arthroscopic injury such as an ACL injury has signs and symptoms of injury. Concussions have become more prevalent, with about 75% of hospital visits regarding head injuries, resulting in the diagnosis of a concussion (Center for Disease Control and Prevention, 2016). While this is deemed as the “invisible” injury, the jolting of the brain when a concussion occurs can cause symptoms that may include headaches, anxiety, irritability and memory impairments (Center for Disease Control and Prevention, 2016). Since there are no

outward physical impairments for concussions, it can be very difficult to predict how long it will take an athlete to recover (National Collegiate Athletic Association, 2014).

As concussions become more common in sports, a greater public concern and health issue has been raised, as more health professionals and researchers gain a better understanding as to what is going on inside the brain (Wiebe, Comstock, & Nance, 2011). Not only have concussions caught the eyes of healthcare professionals, it also affects parents and families who have athletes that have previously sustained concussions. This awareness has prompted all 50 US states to pass laws that will address these concussions to help protect, athletes, parents and coaches in the hopes to provide further research to ensure better brain health (Kirschen, Tsou, Nelson, Russel, & Larrivierre, 2014).

This paper reviews previous studies that have been conducted in the past ten years (2009-2019) from a variety of different researchers. The primary focus of this literature review is to raise awareness of the psychological hindrances that may affect an athlete after sustaining an ACL injury or a concussion by creating different categories that an athlete may experience such as anxiety, depression, fear, etc.

Methodology

This thesis reviewed a variety of studies and summarized their findings related to the psychological factors that may be hindering the athletes' return to sport after an ACL injury or concussion. The literature was synthesized from databases such as that of PubMed, SportDiscus and PsycInfo to provide information about different types of barriers in return to sport. Certain key words such as: "fear", "anxiety", "anterior cruciate ligament injuries", "ACL injuries", "fear of re-injury", "concussions" or "psychological hindrances in return to sport", were used. This knowledge was integrated from articles no later than 10 years ago, ranging in years from 2009-2019, and in the English language. This synthesized information could be helpful for the athletic community to allow for a better understanding of the physical and psychological barriers present in the athlete to be able to return to sport.

Each article was separated into its own respective sub-category, specifically separated into ACL and concussion articles. The types of categories the information would be labeled under was determined ahead of time and then categorized by deductive coding. Once the categories were determined, the data that was highlighted in each article was read through a second time to determine which research and data would best fit the categories. From there, the information for each sub-category was placed underneath its respective heading.

For ACL injuries, the articles were grouped in the following categories: self-reported fear and fear of re-injury, and psychological factors hindering return to sport; psychological factors including stress, self-efficacy, and social and contextual factors. For concussions, the articles were separated into the following categories: recovery patterns after sustaining a concussion, depressive symptoms occurring post-concussion, anxiety and social support post-

concussion, return to play after sustaining a concussion, and the future risk of sustaining a concussion.

Article Summary

The next section of this literature review will focus on each of the individual categories for ACL injuries and concussions, respectfully. These summaries will provide insight into the psychological hindrances in each respective sport.

Summary of Articles for ACL Injuries

Self-Reported Fear and Fear of Re-injury

Articles surrounding the topic of fear and fear of re-injury were included in this review. To determine an athlete's self-reported fear at the time of return to sport (RTS), Paterno and colleagues created a study in which they compared self-reported fear as well as the incidence of a second ACL injury within 24 months of that athlete sustaining their first injury (Paterno, Flynn, Thomas, & Schmitt, 2018). Categories were created for individuals that had undergone ACL reconstruction (ACLR) ranging in ages from 10-25 years of age. Fear was measured with the Tampa Scale of Kinesiophobia (TSK-11; George, Lentz, Zeppieri, Lee, & Chmielewski, 2012), with the participants separated into two groups. Those who scored a 17 or greater on the TSK-11 were in the high fear group and those that scored 16 and lower were in the low fear group (George et al, 2012).

Activity level was measured by the Marx Activity Rating Scale (MARX; Marx, Stump, Jones, Wickiewicz, & Warren, 2001) to measure cutting and pivoting activities for each of the participants. Once again, two groups were created; those scoring 16 or higher on the MARX were in the high activity group and those scoring one or lower were in the low activity group (Marx et al, 2001). A single leg hop measurement was also used to determine dexterity of the leg

as well. To measure strength of the participant's knee, an isometric quadriceps femoris (QF; Larsen, Farup, Lind, & Dalgas, 2015) was used to measure how much the knee of the patient was able to flex. First, the uninjured knee was tested and then the knee that had undergone ACLR, to compare functional movements and patterns of both knees. Each participant was also contacted for a period 24-month period after the testing occurred to monitor if any participant would sustain a second ACL injury (Paterno et al, 2018).

Results of the study showed that those who reported a greater fear on the TSK-11 were up to four times more likely to show lower levels of activity once they had undergone ACLR. Comparatively, those who had returned to their normal states of performance prior to injury often reported higher levels of fear when demonstrating pivoting and cutting motions. This higher self-reported fear also led to those athletes having a higher risk of suffering a second ACL injury within the 24-month period in which the participants stayed in contact throughout the study (Paterno et al, 2018).

Tripp, Stanish, Ebel-Lam, Brewer, & Birchard (2011) conducted a similar study about confidence in RTS for athletes 1 year after having undergone ACLR. The TSK-11 scale was used once again to measure the psychological aspects of the participant returning to sport. The Shortened Profile of Mood States (S-POMS; Shacham, 1983) was also used to measure mood states of those who had undergone ACLR. The S-POMS consists of 37 topics for six different emotion categories which include: tension/anxiety, depression/dejection, anger/hostility, fatigue/inertia, vigor/activity and concussion/bewilderment (Shacham, 1983). A Pain Catastrophizing Scale (Sullivan, Bishop, & Pivik, 1995), a 13-item scale, was also used to ask participants questions about their thoughts and feelings about pain after ACLR.

Two items were also used to determine how ready an athlete was to RTS. To measure confidence, the Sport Self Confidence Inventory (Vealey, Hayashi, Garner-Holman, & Giacobbi, 1998), consisting of 13 different topic areas, was used to assess the confidence participants had about participation in sports. Those that scored a 1 were said to have low confidence and those that scored a 9 had high confidence (Vealey et al, 1998).

The results of this study showed that those who had a high fear of re-injury and negative mood states after ACLR were more likely to have low confidence in RTS. This correlation was evident in those that reported a higher fear of sustaining a second ACL injury and were more likely to see lower levels of return to sport in their respective sport(s) (Tripp et al, 2011).

Psychological Factors Affecting Return to Sport

Nwachukwu, Adjei, Rauck, Chala, Okoroha, Verma, Allen, & Williams (2019) conducted a study in which they researched the different factors that affected return to play (RTP). They found factors that affected RTP both at the pre and post-operative level for athletes, which seemed to vary. At the preoperative level, they found that motivation of RTP, importance of RTP, and the possibility of RTP played a huge role in the psychological readiness for an athlete to return to their sport. At the postoperative level, they found other variables that played a factor in RTP. These variables were the motivation they felt during rehabilitation such as physical therapy, self-esteem throughout the recovery process, their locus of control (in terms of their health) and also varying states of mood (Nwachukwu et al, 2019). There are many variables that affect an athlete when they are planning on returning to their respective sport, but fear of re-injury is still the most common fear for RTP.

A study conducted by Ardern, Taylor, Feller, Whitehead, & Webster (2013) found that positive or negative mental states may influence athletes' decisions in RTS. If an athlete has a

positive psychological response to surgery and postoperative rehabilitation such as using crutches or physical therapy, they are more likely to RTS after a 12-month period than those who have a negative psychological response to RTS (Ardern et al, 2013). While a patient is undergoing rehabilitation, it is essential to ensure this is included in the recovery process to allow for a quicker return to sport for athletes.

Previous studies have focused on the psychological readiness of an athlete after sustaining an ACL injury. However, there are occasions where an athlete will sustain a second injury. Webster, Nagelli, Hewett, & Feller (2018) conducted a study in which they focused their research on psychological readiness when an athlete has sustained a second ACL injury after undergoing ACLR for their first injury. Psychological readiness was determined by the Anterior Cruciate Ligament Return to Sport After Injury Scale (ACL-RSI, Webster & Feller, 2016). This scale measures an athlete's emotion, confidence and risk appraisal. For independent measures, there were five variables that were measured: surgical timing (the timing in between when an athlete sustained their injury to the time they underwent surgery), pre-injury sports participation (how active the athlete was in their sport before the injury occurred), knee laxity (how much an athlete is able to bend their knee), limb symmetry index (how similar each athlete's knees are) and subjective knee symptoms and functions, reported by the patient (Webster et al, 2018).

The results for this study suggested that athletes who were young males, compared to young females, had a decreased time between injury and surgery, had a high level of pre-injury sports participation, had a higher limb symmetry, higher knee scores, and reported a higher psychological readiness for RTS after sustaining a second ACL injury, suggesting that there may be sex differences with this type of injury. These higher subjective knee scores combined with a confidence to ensure proper rehabilitative outcomes, is also correlated with a higher

psychological readiness to RTS (Webster et al, 2018). These sex differences have also been demonstrated in another study by Ardern and colleagues about men that have a higher psychological readiness to RTS. They also suggested that male athletes are also more likely to return to their previous level of competition prior to the injury over female athletes (Ardern et al, 2014).

While there are many studies that have been previously published that focus on why an athlete may be experiencing the emotions post-injury, there may be another explanation about this “fear” that athletes experience when they RTS. Walker, Thatcher and Lavallee (2010) conducted a study in which they focused on the topic of “re-injury anxiety”. This concept centers around that fact that fear may not be the proper term to use for what an athlete is experiencing when they RTS. Fear, Walker and colleagues state, is more of a biological response but anxiety on the other hand, is more of the anticipatory feeling that an athlete may experience when they are contemplating the timeframe in which they should RTS (Walker et al., 2010). This could also correlate with psychological readiness; if an athlete reports more of the “re-injury anxiety”, then they may exhibit lower levels of psychological readiness to RTS.

Psychological Factors: Stress, self-efficacy, and social and contextual factors

Further research has demonstrated that there is also more specific information about psychological factors affecting readiness to RTS, including self-efficacy, stress, social, and contextual factors. A study conducted by Everhart, Best, & Flanigan (2015) focused on three psychological domains that affect RTS: fear avoidance, self-efficacy, and stress and health. To measure fear, the Fear Avoidance Model (Letham, Slade, Troup, & Bentley, 1983), was used in which they found that those who had a negative outlook response to the injury, also had a negative emotional response to their ACL injury. To measure self-efficacy, the Theory of Self

Efficacy (Bandura, 1977), was used. Using this measurement, it was found that having a patient set goals and portray positive self-talk performed better in their rehabilitative measures and thus had a higher level of RTS (Everhart et al., 2015). Stress and health were measured by the Stress, Health and Buffering Hypothesis (Cohen & Wills, 1985). It was found that individuals with higher stress combined with social support had better exercise completion both on their own and in physical therapy. However, to achieve these positive results, athletes must be willing to push past the fear of sustaining another injury to their ACL and be willing to return to their sport at the same level as they previously were (Everhart et al., 2015).

A second article by Ardern, Kvist & Webster (2015) focus on the physical, social and contextual factors that play into psychological readiness for an athlete to RTS. There are many psychological factors that affect RTS as illustrated by figure (1). There can be physical impairments, such as muscle strength, pain, stability of the knee, swelling of the knee and the overall movement of the knee. Social and contextual factors also play a big role as well, where athletes may feel their quality of life may not be the same or they are too optimistic or too pessimistic about the recovery outcomes. Another limitation may come from the overall performance of an athlete's knee, focusing specially on motor control as well as balance (Ardern et al, 2015).

As illustrated by figure (1), all of these factors are intertwined with one another, as well as combined with others. Certain variables such as the cause and severity of the injury could play a large component in an athlete's psychological readiness to RTS. Sociodemographic factors such as age, sex, ethnicity and socioeconomic status could also play a large factor in RTS (Ardern et al, 2015). Factors such as these could hinder an athlete's rehabilitative measures,

which may affect the outcome an athlete may experience in physical therapy which may lead to a decreased level of psychological readiness.

Summary of Articles for Concussions

Concussions are injuries that occur inside the brain hence researchers cannot see them properly to diagnose and understand them. But there is a plethora of symptoms that can be seen and used as a means to help better understand what is happening inside of the brain after it has been jolted by an outside force. Concussions can have physical symptoms, which can stem from headaches to feelings of dizziness; cognitive problems such as difficulty with memory and the inability to concentrate, trouble sleeping, and emotional disruptions such as irritability and anxiety (Kontos, Elbin, Schatz, Covassin, Henry, Pardini, & Collins, 2012). These symptoms will be analyzed in further detail in the following sections.

Recovery Patterns After Sustaining a Concussion

Recovery patterns after an athlete sustains a concussion can often be difficult since there are a variety of symptoms that an athlete can possess. These symptoms are also based on the athlete's self-report, which may not be one hundred percent reliable, based on individual differences. A study conducted by Teel, Marshall, Shankar, McCrea, and Guskiewicz (2017) focused some of the symptoms that may occur after sustaining a concussion. They determined that an athlete that had loss of consciousness (LOC) may experience amnesia, which may occur in two types. Athletes may experience post-traumatic amnesia in which the athlete would not be able to remember anything after sustaining the concussion. Other times, they may experience retrograde amnesia, where an athlete would not be able to remember anything prior to the concussion occurring (Teel et al, 2017). This information was used in augmentation to three

additional measures used to assess concussion symptoms, psychological assessments, and balance which are detailed below.

The Graded Symptom Checklist (GSC; Iverson, 2007) was used to determine symptoms, ranging on a scale from 0-6 with 6 being the most severe. This measure recorded four different types of symptoms: somatic (early and evolving onset), cognitive, and neurobehavioral symptoms. Early onset somatic symptoms could be dizziness, headaches, nausea and vomiting. Evolving onset somatic symptoms could include drowsiness and fatigue. Cognitive symptoms could be having a hard time concentrating and remembering, and neurobehavioral symptoms could range from difficulty sleeping to sadness (Teel et al, 2017).

The Standardized Assessment of Concussion (SAC; Slobounov, Slobounov, Sebutianelli, Cao, & Hewell, 2007) was used to measure concentration, orientation to the room and objects, immediate and delayed memory, sensation, strength, and coordination. This was measured in a range of 0-30, with a lower score meaning that the athlete possessed worse symptoms. The Balance Error Scoring System (BESS; Covassin, Stearne, & Elbin, 2008) was used to measure balance on each individual, as well as both legs. This was measured with a range of scores from 0-60, with the higher the score denoting worse balance.

These assessments showed that those who had previously suffered from loss of consciousness (LOC) and suffered from 0-30 minutes of amnesia were more likely to have worse symptoms in any category. Those who had over thirty minutes of amnesia had worse balance while athletes who sustained more than two concussions in their athletic history also experienced worse balance overall (Teel et al, 2017).

Anxiety and Social Support After Sustaining a Concussion

Psychological traits and symptoms can impose as much of a hindrance on an athlete after a concussion, just as if they were to sustain an injury that would require surgery. A study conducted by Covassin, Crutcher, Bleecker, Heiden, Dailey, & Yang (2014) focused on the anxiety and the amount of social support an athlete receives from anyone they may interact with after they have sustained their concussion. This was also compared with the social support that an athlete may experience if they have undergone an orthopedic surgery, such as an ACLR.

The State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) was used to determine how much anxiety an athlete experienced. For this, there were two types: state anxiety and trait anxiety. State anxiety is measured by how much an athlete experiences anxiety in the moment about different scenarios they may be presented with during rehabilitation and RTS. Trait anxiety measures how much anxiety an athlete feels in general about different scenarios (Spielberger et al, 1983). The 6 Item Social Support Questionnaire (ISSQ; Sarason, Sarason, Shearin, & Pearce, 1987) was used to assess the amount of social support an athlete felt, which was broken into two parts. Athletes were first asked to give their information about the social support they received and were then asked to rate the overall satisfaction they felt from this social support.

The results were quite similar when compared with athletes that had an orthopedic surgery compared to those that had sustained a concussion. Athletes who had sustained a concussion received social support from family (89%), friends (78%), teammates (65%), physical therapists (48%), coaches (47%), and doctors (35%). Those who had undergone an orthopedic surgery were also relatively similar, with their highest amount of social support also coming from family and friends (Covassin et al, 2014). It was also found that athletes after a concussion were more likely to show trait anxiety. Having positive social support after a

concussion also allows for the athlete to reduce their stress and having a positive perception of the social support they received, also influenced the reduced levels of anxiety (Covassin et al, 2014).

Depressive Symptoms in Concussed Athletes

Along with stress and anxiety an athlete may incur after sustaining a concussion, there is also the possibility for depressive symptoms to become prevalent. A study conducted by Roiger, Weidauer, & Kern (2015) showed the results of depression in patients that had received a concussion. They used the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977) to assess depressive states, 1 week, 1 month and 3 months post-concussion. They found that after the timeframe of one week, athletes showed the most depressive symptoms. These symptoms decreased over time between the one week and one-month time frame. However, none of these levels posed these athletes to be at risk for a clinical diagnosis for depression (Roiger et al., 2015).

A similar study conducted in 2018 also found similar findings as Roiger and colleagues did. This research compared depressive symptoms to those that had undergone orthopedic injuries and found that athletes that had sustained a concussion also showed higher rates of depressive symptoms. They also used the same measure, the CES-D, to assess the depressive symptoms in concussed athletes (Guo, Yang, Yi, Singichetti, Stavarinos, & Peek-Asa, 2018).

Post-Concussion Return to Play Expectations

Similar to ACL injuries, there is also a certain timetable deemed both safe and suitable for an athlete to return to their respective sport. Since concussions are a closed head injury, it makes it more difficult to determine when an athlete should be cleared to play. A study

conducted by Kelly and Erdal (2016) aimed to identify some characteristics that may provide more insight to the timeframe in which athletes can RTS.

The State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) was once again used to determine anxiety post-concussion. The Neurobehavioral Symptom Inventory (NSI; Cicerone & Kalmar, 1995) was used to measure traumatic brain injury (TBI) symptoms, as well as the Illness Perceptions Questionnaire-Revised (IPQ-R; Moss-Morris, Weinman, Petrie, Horne, Cameron, & Buick, 2002) to assess how the concussion affected the athlete's life.

The results of this study illustrated that those who had a history of concussions were more likely to exhibit more of the post-concussion symptoms. If an athlete also identified as being more athletic prior to their concussion, they also were seen to exhibit less days in between when they sustained the injury and when they decided to RTS (Kelly & Erdal, 2016). It was also found that amnesia, loss of consciousness, the type of concussion symptom, and LOC played a significant role in an athlete's decision to RTS (Teel et al, 2017). Concussions being a closed head injury are subject to many self-reported symptoms or instances where an athlete may say they are ready to return to their sport when they inherently may not be. Lower rates of fear of re-injury have been shown to be present in athletes, post-concussion due in part to self-report (Guo et al, 2017). Anxiety has also been shown to decrease over time because the injury may not be taken as seriously as an orthopedic injury, such as that of an ACL injury (Guo et al, 2017).

Future Risk of Concussions

Concussions will continue to be prevalent in athletes, as there will always be those who partake in sports. A study by Baugh, Kroshus, Kiernan, Mendel, and Meehan (2017) researched the topic of future concussions and found that when assessed, 40% of Division 1 athletes said

they could see the possibility of themselves receiving a concussion in the future in their respective sport. There are also many health consequences that could occur in the future such as dementia, chronic traumatic encephalopathy (CTE), and Alzheimer's disease (Baugh et al, 2017). Many of these diseases are not yet well studied in the realm of concussions and may pose a serious threat to those who have sustained one or multiple concussions.

The unknown realm of concussions can also lead to the under or over estimation of the risks that are associated with concussions, which can both be causes of concern (Baugh et al, 2017). If an athlete overestimates their risk, they may cease playing the sport altogether. If they choose to underestimate the physical and cognitive risks of concussions, they may cause more concussions if they do not follow doctor's protocol guidelines, and possibly incur health issues such as CTE and dementia in the future.

Discussion

Concussions and ACL injuries are quite common in sports and this literature review illustrates some of the psychological hindrances that could be in place for those that have sustained either or both of these injuries and their timeframe in which they return to their respective sport at or below the same level of competition pre-injury.

Table 1 shows the psychological hindrances that are present in ACLs and concussions. While each respective sport has their own hindrances specific to the injury, there is still some overlap. This is illustrated by the third column which illustrates the shared psychological hindrances present in both ACLs and concussions.

ACL injuries see patients reporting the severity of their injury as a psychological hindrance when returning to sport (RTS). According to Ardern et al, (2015), the severity of the injury which is perceived by the individual may affect their psychological readiness, especially

in rehabilitative measures, such as physical therapy. If a patient feels that their injury is too severe, they may not want to return on the specified time table their doctor has advised them to follow or they may personally hinder themselves by not taking rehabilitation as seriously as they should, which would delay their return to sport.

Motivation also plays a new role in how ready an athlete is to return to sport. This is especially seen during rehabilitation during physical therapy, all the way into the return to their sport (Nwachukwu et al, 2019). The motivation to return can also be hindered by the severity of the injury mentioned above. If an athlete feels their injury is too severe, this may impede the return process, in turn decreasing their motivation.

Physical impairments can also occur on top of what an athlete may be mentally experiencing. Impairments such as muscle strength, pain, knee stability, knee swelling, and knee movement can all play a big role in how much an athlete feels they are able to return to play (Ardern et al, 2015). Many sports injuries have both the physical and mental aspects to it, which is illustrated by this line of research. If an athlete has physical hindrances that inhibit them in their return to their sport, this will inherently have an effect on their mental state and further inhibit them on their return to sport.

Concussions pose their own set psychological hindrances for athletes to return to sport. ACL injuries are an external injury and are easier to heal and provide rehabilitation for. Concussions on the other hand are internal and the time frame for return varies from person to person.

Depression plays a big factor in when an athlete can return to their sport. Depressive symptoms were shown to be higher in athletes who sustained a concussion compared to those that underwent orthopedic injuries, such as ACL injuries (Guo et al, 2018). While these athletes

show depressive symptoms and they are elevated from normal depressive levels, these levels are not a cause for concern for the athlete. Levels are not high enough for a clinical diagnosis and will return to their normal levels once the athlete returns to their sport (Roiger, Weidauer, & Kern, 2015). While depression is a culprit in returning to sport, it can be overcome in the long run.

Pre-injury history can also have an effect on RTS after sustaining a concussion. If athletes had a history of prior concussions, athletes showed a higher likelihood of having post-concussion symptoms (Kelly & Erdal, 2016). These symptoms could include depressive symptoms as mentioned above. If an athlete has prior concussions, they also may experience anxiety that would hinder them even further in the return process.

Concussions also bring with them a lot of cognitive risks that have not been studied as intensely as other injuries. If athletes don't heed their doctor's warnings about the potential risks and choose to either over or underestimate their risks, this could have unseen repercussions decades down the line. Athletes run the risk of developing CTE or dementia, which are not proper means of aging for individuals (Baugh et al, 2017). CTE is also not well studied since this anomaly in the brain cannot be studied until after a patient has passed away.

While ACLs and concussions pose their own distinct psychological hindrances, there is also some overlap that is present in both injuries. Some areas of overlap that have been illustrated in the research is self-reported fear, fear of re-injury, anxiety, and stress.

Those that sustain an ACL injury were seen to have higher levels of fear that were associated with being four times more likely to show lower levels of activity (Paterno et al, 2018). This is shown after the athlete has undergone ACLR and is in the process of being able to return to their sport. Concussed athletes also had self-reported fear. If they self-reported

symptoms such as that of loss of consciousness (LOC) or amnesia, athletes were shown to have a lower time frame in which they returned to sport (Teel et al, 2017).

Fear of re-injury is very common in athletes who have sustained an ACL injury, as they are one of the most common sports injuries for athletes at any stage of play. However, if an athlete was able to set goals and possessed positive self-talk, they were shown to have higher levels of RTS (Everhart, Best, & Flanigan, 2015). In a similar manner, athletes that sustained a concussion and had lower self-reported fear, had a lower fear of re-injury (Guo et al, 2017). This could also factor into a concussion being an invisible injury, since there may not be any physical symptoms seen in concussed athletes.

Anxiety and stress go hand in hand for both ACLs and concussions. For ACL injuries, even if athletes had a higher stress level, as long as they had a good amount of social support, then they still had better physical therapy outcomes. These combined factors allowed for an overall lower stress level when deciding to RTS. However, an athlete would have to push past the fear of a second ACL injury to get to their previous level, which would mean that they would have to surpass their levels of stress (Everhart, Best, & Flanigan, 2015).

For concussions, those who experienced high trait anxiety was shown to decrease over time to help aid in their return to sport (Guo et al, 2017). Similarly, to ACL injuries, athletes that sustained concussions, but had a higher level of social support were able to reduce their stress levels. This was also shown to have a positive perception of social support and show an overall reduction level in anxiety (Covassin et al, 2014).

As illustrated by Figure (1) and the findings from the researchers, there are many different psychological hindrances that affect an athlete's RTS. There is not just one thing that is the culprit to hindering an athlete for either an ACL injury or a concussion. There is also not just

something physical that underlies the measures, rather the mental capacity of the athlete can have an even larger impact on an athlete's decision to report to sport.

Conclusion

ACL injuries and concussions are some of the most prominent injuries that are prevalent in sports at any level. This literature review summarizes the psychological hindrances that affect return to sport after sustaining an ACL injury or concussion and provides future directions that could be beneficial to the athletic community. First and foremost, it could bring more awareness to ACL injuries and concussions, since this literature review focuses on the psychological factors inhibiting an athlete's return. By creating this list of potential psychological factors that play a role in hindering athletes from returning to sport could allow for the athletic community to be better equipped to provide the best type of help for the athletes to return to the sport smoothly. This literature review could also spark the interest of medical professionals to incorporate better rehabilitative practices into their work with athletes. In doing so, this will create interest in carrying out new studies to see how athletes will respond to different types of rehabilitation when it comes to returning after injury.

References

- Ardern, C. L., Kvist, J., & Webster, K. E. (2015). Psychological aspects of anterior cruciate ligament injuries. *Operative Techniques in Sports Medicine*, 24(1), 77-83.
- 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.
- Ardern, C. L., Taylor, N. F., Feller, J. A., & Webster, K. F. (2012). Return-to-sport outcomes at 2 to 7 years after anterior cruciate ligament reconstruction surgery. *American Journal of Sports Medicine*, 40:41-48.
- Ardern, C. L., Taylor, N. F., Feller, J. A., & Webster, K. F. (2014). Fifty-five percent return to competitive sport following anterior cruciate ligament reconstruction surgery; an updated systematic review and meta-analysis including aspects of physical functioning and contextual factors. *British Journal of Sports Medicine*, 48:1543-1552.
- Ardern, C. L. (2015). Anterior cruciate ligament reconstruction- not exactly a one-way ticket back to the preinjury level: a review of contextual factors affecting return to sport after surgery. *Sports Health: a multidisciplinary approach*, 7(3), 224-230.
- Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychology Review*, 84(2):191.
- Baugh, C. M., Kroshus, E., Kiernan, P.T., Mendel, D., & Meehan, W. P III. (2017). Football players' perceptions of future risk of concussion and concussion-related health outcomes. *Journal of Neurotrauma*; 34: 790-797.

- Centers for Disease Control and Prevention. (2016). *Injury prevention and control: traumatic brain injury and concussion*. https://www.cdc.gov/traumaticbraininjury/get_the_facts.html
- Cicerone, K. D., & Kalmar, K. (1995). Persistent post-concussion syndrome: The structure of subjective complaints after mild traumatic brain injury. *Journal of Head Trauma Rehabilitation, 10*, 1-17.
- Cohen, S. & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin, 98*(2): 310-357.
- Covassin, T., Crutcher, B., Bleecker, A., Heiden, E. O., Dailey, A., & Yang, J. (2014). Postinjury anxiety and social support among collegiate athletes: a comparison between orthopedic injuries and concussions. *Journal of Athletic Training, 49*(4): 462-468.
- Covassin, T., Stearne, D., & Elbin, R. (2008). Concussion history and postconcussion neurocognitive performance and symptoms in collegiate athletes. *Journal of Athletic Training, 43*(2):119-124.
- Everhart, J. S., Best, T. M., & Flanigan, D. C. (2015). Psychological predictors of anterior cruciate ligament reconstruction outcomes: a systematic review. *Knee Surgery Sports Traumatology and Arthroscopy, 23*:752-762.
- George, S. Z., Lentz, T. A., Zeppieri, G., Lee, D., & Chmielewski, T. L. (2012). Analysis of shortened versions of the Tampa Scale for Kinesiophobia and Pain Catastrophizing Scale for patients after anterior cruciate ligament reconstruction. *Clinical Journal of Pain, 28*:73-80.
- Guo, J., Yang, J., Yi, H., Singichetti, B., Starvinos, D., & Peek-Asa, C. (2018). Differences in postinjury psychological symptoms between collegiate athletes with concussions and orthopedic

injuries. *Clinical Journal of Sports Medicine*. Advance online publication. Doi: 10.1097/JSM.0000000000000621

- Irrgang, J. J. (1993). Modern trends in anterior cruciate ligament rehabilitation, nonoperative and postoperative management. *Clinics in Sports Medicine*, 12: 797-813.
- Iverson, G. (2007). Predicting slow recovery from sport-related concussion: the new simple-complex distinction. *Clinical Journal of Sports Medicine*, 17(1):31-37.
- Kelly, K., & Erdal K. (2016). Diagnostic terminology, athlete status, and history of concussions affect return to play expectations and anticipated symptoms following mild traumatic brain injury. *Journal of Clinical and Experimental Neuropsychology*, 39(6). 587-595.
- Kim, S., Bosque, J., Meehan, J. P., Jamali, A., & Marder, R. (2011). Increase in outpatient knee arthroscopy in the United States: a comparison of National Surveys of Ambulatory Surgery, 1996 and 2006. *Journal of Bone and Joint Surgery*, 93 (11): 994-1000.
- Kirschen, M. P., Tsou, A., Nelson, S. B., Russell, J. A., & Larriviere, D. (2014). Ethics, law, and humanities committee, a joint committee of the American Academy of Neurology, American Neurological Association, and Child Neurology Society. Legal and ethical implications in the evaluation and management of sports-related concussions. *Neurology*, 83(4): 352-358.
- Kontos, A. P., Elbin, R., Schatz, P., Covassin, T., Henry, L., Pardini, J., & Collins M.W. (2012). A revised factor structure for the post-concussion symptom scale: baseline and post-concussion factors. *The American Journal of Sports Medicine*; 40(10): 2375-2384.
- Larsen, J. B., Farup, J., Lind, M., & Dalgas, U. (2015). Muscle strength and functional performance is markedly impaired at the recommended time point for sport return after anterior cruciate ligament reconstruction in recreational athletes. *Human Movement Science*, 29: 73-87.

- Lethem, J, Slade, D.G., Troep, J.D.G., & Bentley, G. (1983) Outline of a fear-avoidance model of exaggerated pain perception. *Behavior Research and Therapy*, 21(4): 401-408.
- Marx, R. G. Stump, T. J., Jones, E. C., Wickiewicz, T. L., & Warren R. F. (2001). Development and evaluation of an activity rating scale for disorders of the knee. *American Journal of Sports Medicine*, 29:345-353.
- Moss-Morris, R., Weinman, J., Petrie, K., Horne, R., Cameron, L., & Buick, D. (2002). The revised illness perception questionnaire (IPQ-R). *Psychology and Health*, 17:1-16.
- National Collegiate Athletic Association (2014). *Mind, body and sport: understanding and supporting student-athlete mental wellness*.
https://www.naspa.org/images/uploads/events/Mind_Body_and_Sport.pdf.
- Nwachukwu, B. U., Adjei, J., Rauck, R. C., Chahla, J., Okoroha, K. R., Verma, N. N., Allen, A.A Williams, R. J. (2019). How much do psychological factors affect lack of return to play after anterior cruciate ligament reconstruction? A systematic review. *Orthopedic Journal of Sports Medicine*, 7(5), 1-7.
- Paterno, M. V., Flynn, K., Thomas, S., & Schmitt, L. C. (2018). Self-reported fear predicts functional performance and second ACL injury after ACL reconstruction and return to sport: A pilot study. *Sports Health: A Multidisciplinary Approach*, 10(3), 228–233
- Radloff, L. S. (1997). The CES-D scale- a self-report depression scale for research in the general population. *Applied Psychological Measurement*; 1:385-401.
- Roiger, T., Weidauer, L. & Kern, B. (2015). A longitudinal pilot study of depressive symptoms in concussed and injured/nonconcussed national collegiate athletic association division 1 student-athletes. *Journal of Athletic Training*, 50(3): 256-261.

- Sarason, I., Sarason, B., Shearin, E., & Pierce, G. A brief measure of social support: practical and theoretical implications. *Journal of Social and Personal Relationships*, 4(4):497-510.
- Shacham, S. (1983). A shortened version of the Profile of Mood States. *Journal of Personality Assessment*, 47: 305-306.
- Slobounov, S., Slobounov, E., Sebastianelli, W., Cao, C., & Newell, K. (2007). Differential rate of recovery in athletes after first and second concussion episodes. *Neurosurgery*, 61(2): 169-173.
- Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R. & Jacobs, G. A. (1983). Manual for the state trait anxiety. *Consulting Psychologists Press*.
- Sullivan, M. J., Bishop, S., & Pivik, J. (1995). The Pain Catastrophizing Scale: development and validation. *Psychological Assessment*, 7:524-532.
- Teel, E. F., Marshall, S. W., Shankar, V., McCrea, M., & Guskiewicz, K. M. (2017). Predicting Recovery Patterns After Sport-Related Concussion. *Journal of Athletic Training*, 52(3): 288-298.
- Tripp, D. A., Stanish, W., Ebel-Lam, A., Brewer, B. W., & Birchard, J. (2011). Fear of reinjury negative affect, and catastrophizing predicting return to sport in recreational athletes with anterior cruciate ligament injuries at 1-year postsurgery. *Sport, Exercise, and Performance Psychology*, 1(5), 38-48
- Vealey, R., Hayashi, S.W., Garner-Holman, M., & Giacobbi, P. (1998) Sources of sport confidence: conceptualization and instrument development. *Journal of Sport and Exercise Psychology*, 20:54-80.
- Walker, N., Thatcher, J., & Lavalley, D. (2010). A preliminary development of the Re-Injury Anxiety Inventory (RIAI). *Physical Therapy Sport*, 11:23-29.

- Webster, K. E., Nagelli, C. V., Hewett, T. E., & Feller, J. A. (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.
- Webster, K. E. & Feller J. A. (2016). Exploring the high injury rate in younger patients undergoing anterior cruciate ligament reconstruction. *American Journal of Sports Medicine*, 11: 2827-2832.
- Wiebe, D. J., Comstock, R. D., & Nance, M. L. (2011). Concussion research: a public health priority. *Injury Prevention*, 17, 69-70.

Appendix

Figure (1): Biopsychosocial model of return to sport after injury. Adapted from Ardern, C. L., Kvist, J., & Webster, K. E., Biopsychosocial model (2015).



Table (1): The shared common and different psychological hindrances that may be found in athletes after an ACL injury or concussion.

Injury	Psychological Hindrances	Shared characteristics
ACLs	<ul style="list-style-type: none"> • Motivation to return to sport • Importance of return to sport • Possibility of return to sport • Mood • Emotion • Self-efficacy • Physical impairments • Quality of life • Severity of injury 	<ul style="list-style-type: none"> • Self-reported fear • Fear of re-injury • Self-esteem • Locus of control • Anxiety • Stress • Recovery patterns • Social support
Concussions	<ul style="list-style-type: none"> • Amnesia • Concentration • Coordination • Headaches • Dizziness • Depression • Pre-injury History • Cognitive Risks (CTE and Dementia) 	