Comparing the Psychological Impact of a Concussion versus an ACL Injury

Abstract: I wrote this paper for Kin 2058 Assessment and Evaluation of Athletic Injuries and Illness II (capstone class). This paper examines two of the most common injuries in sport participation, a concussion, and an Anterior Cruciate Ligament (ACL) tear. Both of these injuries cause psychological effects, in the case of a concussion, it is caused from the direct blow to the head, whereas an ACL tears psychological impact stems from fear. In comparing the psychological impacts of the two injuries, it is the ACL tear that has a greater psychological effect that lasts for a longer amount of time then the psychological impacts of a concussion.

Course: Kin 2058 Assessment and Evaluation of Athletic Injuries and Illness II

Semester: Spring 2013

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Concussion versus an ACL Injury

Every sport contains two types of performance hindrances. The first type of hindrance is physical injury such as the possibility of receiving a concussion or tearing a ligament. On the other side of the spectrum is the psychological aspect, which can prevent athletes from performing to the best of their abilities. Two of the more common and significant physical injuries in sports are concussions and Anterior Cruciate Ligament (ACL) tears. Both of these injuries require that an athlete sit out from participation in their sport and has a direct effect on the athletes psyche. In the case of a concussion, the brain has to have time to heal and overcome the cognitive impairments before an athlete can return to play, to which no exact timeframe exists. An athlete that has an ACL tear will have to undergo surgery to repair the torn ligament and go through rehabilitation before being able to return to play; for ACL tears, this process has a set and clear timeline. Despite concussions being a head injury that causes psychological impairment, ACL injuries have a higher psychological impact for a greater amount of time.

Before understanding the psychological impacts of a concussion, it is best to begin by understanding what a concussion is. According to an article from the journal *Brain Injury*, concussions “... account for an estimated 1.6-3.8 million sports injuries per year” what is interesting however, is it does not have one agreed upon definition (Mansell, Tierney, Higgins, Mcdevitt, Toone, & Glutting, 2010, p. 1070). The article defines a concussion as “... a brain injury caused by acceleration forces that are a result of either a direct impact to the head, face, or neck or an indirect impact causing an impulsive force to the brain.” (Mansell, Tierney, Higgins, Mcdevitt, Toone, & Glutting, 2010 p. 1070) It then further describes that “concussive events can create compressive, tensile or shear forces on the brain, causing cell deformation and a
neurometabolic cascade resulting in the manifestation of clinical S&S\(^1\) immediately or hours to
days post-impact” (p. 1070). What this means, is no single concussion behaves the same way;
some athletes may have immediate symptoms while others will show no signs of a concussion
until the following day.

According to an article titled “Sports Concussion: A Return-to-play Guide” (Lear &
Hoang, 2012, p. 325) symptoms can vary and include those listed in Table 1 below.

Table 1
**Signs and symptoms commonly associated with concussion**

<table>
<thead>
<tr>
<th>Sign</th>
<th>Description</th>
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<tbody>
<tr>
<td>Headache</td>
<td>Sensitivity to light</td>
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<tr>
<td>“Pressure in head”</td>
<td>Sensitivity to noise</td>
</tr>
<tr>
<td>Neck pain</td>
<td>Feeling slowed down</td>
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<tr>
<td>Nausea or vomiting</td>
<td>Felling like “in a fog”</td>
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<tr>
<td>Dizziness</td>
<td>“Don’t feel right”</td>
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<tr>
<td>Blurred vision</td>
<td>Difficulty concentrating</td>
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<tr>
<td>Balance problems</td>
<td>Difficulty remembering</td>
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(Lear & Hoang, 2012, p. 325)

The article “Injury Prevention and Control” (CDC, 2010) further explains that, “some of these
symptoms may appear right away, while others may not be noticed for days or months after the
injury, or until the person starts resuming their everyday life and more demands are placed upon
them”. This is another aspect that makes concussion so complex, because an athlete may appear
to be acting and functioning normally, but when they begin to return to their normal routine after
they have apparently recovered they can still have reoccurring or even new symptoms. In other
words, as with all injury rehabilitation, recovering from a concussion follows a specific protocol.

Before treatment for a concussion begins, an evaluation occurs. Although evaluations
may vary slightly they all assess the same things. According to “Sports Concussion: A Return-to-
play Guide” (Lear, & Hoang, 2012 pp. 324-325) the evaluation process tests consists of two
parts, balance testing and assessing cognitive function. The balance testing generally consists of

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\(^1\) S&S stands for signs and symptoms
having the athlete attempting to stand with eyes open and eyes closed with various head positions. A positive test for the balance test is if the athlete has difficulty keeping their balance to the point that they sway or it appears that they may fall (pp. 324-325).

The second aspect of evaluation is to assess cognitive function of the athlete. This typically consists of asking a battery of questions. A publication from Mt. Diablo Memory Center (p. 2), discusses the four aspects tested in the cognitive testing. First is orientation, which includes determining the athlete’s orientation to person, place, time, and event. Next, the test looks at retrograde and anterograde amnesia; this determines the athletes memory before and after the concussion occurred respectively. Finally, it assesses the athlete’s ability to concentrate, which is accomplished in a multitude of ways, but is commonly done by having them say the days of the week backwards or counting backwards from a 100 by a particular set amount (p. 2). Once the examination process is complete, treatment will begin.

According to the “National Athletic Trainers’ Association Position Statement,” no single concussion is identical and “. . .the resulting symptoms can be very different, depending on the force of the blow to the head, the degree of the metabolic dysfunction, the tissue damage and duration of time needed to recover. . .” (Guskiewicz, Bruce, Cantu, Ferrara, Kelly, McCrea, Putukian, & McLeod, 2004, p. 285). It is for this reason that concussions need to be treated on an individual basis with the return-to-play protocol. The article further explains that on average athletes need at least seven days in order to fully recover from the concussion before returning to play (p. 285). To begin the return-to-play process, an athlete must first be symptom free. The first step of the protocol is to have the athlete perform light activities such as riding on an exercise bike. If the athlete does not experience any new symptoms or if symptoms are not made worse with light exertion, the athlete can move to the second step. The second stage of the return
to play protocol is allowing the athlete to perform sport-specific exercises; these exercises are typically various warm-up drills. Once again, if symptoms are not made worse or no other symptoms surface the athlete than moves to sport-specific drills that are non-contact such as throwing or kicking a ball. The fourth stage then involves allowing the athlete to return to a full practice. If the fourth stage still does not cause any further symptoms, the athlete can move to stage five, or full activity; Table 2 by Lear and Hoang further explains this process. If during any point of this protocol, the athlete experiences any new symptoms or symptoms are made worse the athlete must regress back to the previous step. It is for this reason that the time it takes for an athlete to return-to-play can vary for each athlete (p. 286).

Table 2

<table>
<thead>
<tr>
<th>Stepwise protocol for return to play</th>
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<tbody>
<tr>
<td>1. Light aerobic activity</td>
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<tr>
<td>2. Sport-specific exercises</td>
</tr>
<tr>
<td>3. Noncontact training drills</td>
</tr>
<tr>
<td>4. Full-contact practice</td>
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<tr>
<td>5. Game activity</td>
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(Lear, & Hoang, 2012, p. 325)

One of the reasons that concussion signs and symptoms are examined during the return-to-play protocol is to better determine the psychological impairment the athlete is experiencing. According to “Depression, Anxiety, and Stress as Predictors of Postconcussion-like Symptoms in a Non-clinical Sample,” “for most individuals, the postconcussion symptoms experienced in the acute stage of a mild traumatic brain injury (mTBI) resolve within a few days to a few months” (Edmed, & Sullivan, 2012 p. 41).
In general, the first signs of psychological impacts from a concussion typically appear either the day of the concussion or no more than a few days after. As noted in “Concussion Causes Transient Dysfunction in Cortical Inhibitory Networks but not the Corpus Callosum” a concussion causes physiological changes without changing the brain structurally (Hammond-Tooke, Goei, Plessis, & Fanz, 2009, p. 315). This is one aspect that sets concussions apart from other injuries experienced in sport participation. With other injuries, the athlete can generally see or at least feel the dysfunction or deformity, but concussions do not allow someone to do this. The psychological response occurs because of the impact to the brain, rather than the athletes’ response to the injury itself.

According to “Examination of Postconcussion-like Symptoms in Healthy University Students” some of the emotional or psychological symptoms include “... irritability, emotional liability, depression, and anxiety” (Wang, Chan, & Deng, 2006, p. 339). These symptoms typically vary and not every athlete will experience all of them. Again, because a concussion is a brain injury, it is not necessarily that fear, or depression caused the symptoms, but rather that the injury itself did.

One instance that the psychological impacts are commonly studied, for concussions, is when athletes experience symptoms lasting longer than three months. When this occurs, it is known as post-concussion syndrome. According to “Post Concussion Syndrome: The attraction of the Psychological by the Organic,” “psychological and psychiatric symptoms tend to evolve over time, often weeks to months (Macleod, 2010, p. 1033). Something interesting that this studied pointed out, was that “anxiety and affective symptoms may compound and complicate the clinical picture particularly if the initial symptoms do not rapidly dissipate” (p. 1033). What this means is anxiety plays a role in the initial symptoms experienced by an athlete after a
A study from *Rehabilitation Research and Practice* discussed that “psychological factors have also been associated with persisting symptomatology and specifically, with persisting cognitive symptoms (Beaupre, Guise, & Mckerral, 2012, p. 2). However, it is important to note that the psychological symptoms themselves do not cause the cognitive symptoms. Since a concussion causes a physiological change rather than a structural, the damage resulting from the impact causes both the cognitive and the psychological aspect. As the studied pointed out, the frontal cortex of the brain, which is responsible for attention, memory, self-regulation, and executive function, is the area most commonly affected from concussive impacts (p. 2). In several instances, anxiety tended to be the psychological factor that affected postconcussion cognitive symptoms the most during neuropsychological testing.

“Chronic Stress, Somatic and Depressive Symptoms Following Mild to Moderate Traumatic Brain Injury” explains that “chronic stress or persistent state of feeling overwhelmed, out of control, and as if current life situations are unmanageable has been linked to cognitive dysfunction and mental health disorders” (Bay & Covasss, 2012, p. 478). This study, specifically examined how depression related to concussions has “. . . the potential to increase cognitive errors, limit memory storage, and slow information-processing speed” (p. 478). The study used the allostatic load stress theory as a framework for the research. The model explains that,

The allostatic load stress theory, a multivariate biological model of stress, is based on the assumption that the brain regulates reciprocal and flexible stress systems (cardiovascular,
immune, and endocrine system and those involved in metabolic function) to achieve a state of allostasis. Allostasis, the ability to maintain stability through change, can be threatened by chronic stress. (Bay & Covassin, 2012, p. 478)

The idea behind the allostatic load stress theory is that it is a biological response and continued symptoms or cognitive difficulties can cause a negative response resulting in negative health outcomes (p. 478). In relating this back to depression symptoms in people with mild to moderate traumatic brain injuries (concussions), the study found that “. . . chronic psychological stress and somatic symptoms were significantly and positively associated with depressive symptoms” (p. 483). It noted that “. . . persons who reported greater subjective memory complaints also rated their distress and fatigue to be greater” (p. 483). The study further explains that “chronic somatic complaints and stress-related psychosocial factors, such as feeling out of control, being overwhelmed, easily angered, and mounting difficulties, are consistently associated with higher levels of depressive symptoms” (p. 483) all of which commonly occur as a result of a concussion. This model is not specific to concussive injuries alone; negative psychological effects explained in the model can also occur in other orthopedic injuries. The aspect that separates a concussion from other orthopedic injuries is that other injuries can cause the psychological affects, but the athlete can have psychological interventions that help them to move past the psychological factors. However, concussions cause psychological and cognitive impairments physiologically, meaning that psychological interventions will not reduce the psychological effects. In other words, the psychological impact is caused because of the physiological response of the injury, and the extent of the response can lead to continued challenges with cognitive functions.
One aspect that can make understanding the extent of the psychological impacts of a concussion so complicated is the fact that the symptoms can occur even in healthy populations. The term “healthy population” means that people, who have not participated in sports and have no history of a concussion or any other head injury, are used as a control group to compare to signs and symptoms of athletes with a concussion. In the case of one study, the results showed that “healthy populations” could experience the signs or symptoms of a concussion. According to “Depression, Anxiety, and Stress as Predictors of Postconcussion-like Symptoms in a Non-clinical Sample,” “90% of the patients with depression and no history of head injury, met liberal self-report criteria for PCS²” (Edmed & Sullivan, 2012, p. 42).

Edmed and Sullivan further explain that . . . Among college students with and without mTBI histories, greater PCS/postconcussion-like symptomatology was reported by those individuals who: (a) reported a greater number of, and being more impacted by stressful events, (b) had higher levels of subjective stress, and (c) were exposed to higher levels of experimentally induced acute stress. (2012, p. 42)

The important aspect to note is, yes, these symptoms do commonly occur in athletes with post-concussion symptoms; however, the symptoms can also occur in the healthy population and would therefore not be caused by sport participation. A study from the Archives of Clinical Neuropsychology compared the results of the Rivermead Post-Concussion Symptoms Questionnaire (RPQ) in an athletic population and in healthy college students from a Psychology class. The results found that many of the symptoms of PCS were present in both populations.

From the various questions on the questionnaire, “. . . the most commonly reported symptoms in the university study were longer time to think (65.9%), poor concentration (58.9), fatigue (53.5),

² PCS stands for Post-Concussion Syndrome
and sleep disturbance (50.6%)” (Wang, Chan, & Deng, 2006, p. 344). The researchers believe that the students that did not have a brain injury or a history of a brain injury, may have experienced these symptoms because of “. . . personal and psychological issues such as study, work, and emotional state in everyday life” (p. 344). It is for this reason that the researchers suggest to compare concussed athletes symptoms to baseline scores, in order to aid in determining if the athlete has PCS, meaning that the athletes undergo neurocognitive testing prior to sports participation.

Another reason that baseline testing can be a useful tool when determining the severity of the psychological impacts after injury is because it can aid in determining if there is still impairment after and athlete no longer reports symptoms. The study “Neurocognitive Performance of Concussed Athletes When Symptom Free” determined that of a sample of 21 college athletes, that no longer had self-reported concussion symptoms, 38% still had impaired neurocognitive performance in comparing to the athletes baseline scores (Broglio, Macciocchi, & Ferrara, 2007, p. 507). This suggests that, in some instances, even after the typical 1 to 4 weeks that psychological symptoms such as depression, irritability, and anxiety last, the athlete may still experience impairment in “verbal memory, visual memory, visual-motor speed, and reaction time” (p. 505). However, these impairments are ultimately separate from the psychological effects of a concussion.

Another injury that commonly occurs in contact sports is an anterior cruciate ligament or ACL tear, the main stabilizing ligament of the knee. According to “Anterior Cruciate Ligament (ACL) Injury-Overview,” an ACL tear is a “. . . over-stretching or tearing of the anterior cruciate
ligament (ACL) in the knee” this tear will be either a partial tear or a complete rupture (Ogiela, 2009).

An ACL tear, is then classified as to how it occurred, either a contact or noncontact tear. A contact tear occurs because of a direct blow to the athlete’s knee resulting in excessive force at the knee ultimately leading to a “pop” indicating that the ACL has torn or ruptured. A noncontact tear does not have an outside force placed upon it, it can occur because the athlete became off balance and experienced either an excessive rotational force or excessive hyperextension, which will then lead to an ACL tear. Noncontact ACL injuries tend to have more focused placed on them for two reasons. One reason is because a contact ACL tear is easily understood because there is a clear mechanism that causes the injury, whereas a noncontact tear may be more complicated especially if there does not appear to be a direct cause. The second reason there is a more of a focus on research for noncontact tears is because the noncontact tear can be preventable.

Regardless of whether the ACL tear is contact or noncontact, the signs and symptoms are the same. In Examination of Orthopedic and Athletic Injuries (Starkey, Brown, Ryan, 2010 p. 329), one of the main symptoms of an ACL tear is hearing a “pop.” The injured athlete may also experience a feeling of laxity and a decrease in the range of motion (p. 329). In addition, an article from the American Academy of Orthopedic Surgeons described that other common symptoms include loss of range of motion, tenderness along the joint line, and discomfort while walking (American Academy of Orthopedic Surgeons, 2009). In general, ACL tears do not vary greatly in the end they all have the same prognosis.

Whether or not an ACL is partially torn or completely ruptured, the athlete will have to undergo surgery in order to repair the tear. This is one of the major causes of the psychological

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3 When using the term ACL rupture, it means that the ligament has torn completely.
affects in athletes. ACL tears have not always been an injury that athletes could return to athletics from; it was classified as a career ending injury. According to Russell Warren an orthopedic doctor for the New York Giants, “early methods of surgery involved repairing the ligament or using a synthetic material to replace the ligament, but the failure rate was very high” (2012).

He further explains that

In the 1970’s, an athlete who had undergone ACL surgery was required to wear a cast and not move their leg for six weeks. As a result, the ligament often remained loose and did not stabilize the knee. In addition, when the cast was removed, the knee joint was very weak and stiff.” (Warren, 2012)

This was likely one of the major reasons an ACL tear was considered a career ending injury because even with surgery it was not likely that the athlete would ever recover to a functional enough state to continue sport participation. These dreary outcomes lead to a negative psychological effect on many athletes because they were forced to give up their passion of playing their sport.

What is interesting is that despite forty years of advancement in the medical field, which allows athletes to undergo surgery and return to their sport, ACL tears still carry a psychological impact. In the study “Psychological Readiness for Anterior Cruciate Ligament Surgery,” the researchers were comparing the readiness an adolescent had to undergo ACL surgery to an adult, especially when comparing mood-disturbance levels. For the case of the study, adolescents were defined as being between the ages of fifteen and nineteen years old, and the adult age group ranged between twenty to forty-eight years of age (p. 168). One component of the study was for both age groups to complete the short-form Profile of Mood States (POMS-SF), of which “five
[subscales] assess negative mood states (i.e., tension, depression-dejection, anger, fatigue, and confusion) and 1 assesses positive mood (i.e., vigor)” (Udry, Shelbourne, & Gray, 2003, p. 168). The study found that the adolescent group reported experiencing higher levels of mood disturbance than the adult group; the adolescent’s mean score was 25.5 compared to 18.1 for the adults. What this study was attempting to point out is initially after injury adolescents, which of the total sample contained 90% involved in sports or regular physical activity, experienced higher negative mood disturbance than adults with the same injury. Although the study notes that it could not be completely proven from there results, it was believed that the adolescents experienced a higher mood disturbance, because in a general sense, “...mood disturbances are more common among adolescents.” The other belief was that “...adolescent patients simply experienced more negative effects after their injuries” (Udry, Shelbournet, & Gray, 2003, p. 170).

Another psychological occurrence with ACL surgery relates to the pain experience post-surgery. The study, “The Subjective Pain Experience of Athletes Following Anterior Cruciate Ligament Surgery” states that “surgery is a word that strikes fear in the heart of the injured athlete and pain is described as the most pervasive and debilitating obstacle to effective rehabilitation experienced by injured athletes” (Tripp, Stanish, Coady, & Reardon, 2003, p. 340). One of the reasons behind this is that “anxiety is positively associated with both higher pain and the greater use of postoperative medications (p. 341). In other words, an athlete experiencing high anxiety prior to surgery will experience a greater amount of pain after surgery than an athlete with less or no anxiety going into surgery. In addition, those who have minor depressive symptoms also had a 44% less tolerance to pain than someone not experiencing this type of mood disturbance (p. 341). What this amounts to is that the amount of pain an athlete with an
ACL tear experiences can be influenced by the severity of their mood disturbance. An athlete with a positive outlook on surgery and a stronger belief that their knee will heal through the rehabbing process, is less likely to experience as much pain after surgery and will likely begin rehab sooner than an athlete with more psychological distress.

One study refers to this positive outlook of athletes as self-efficacy. According to “Longitudinal Changes in Psychosocial Factors and their Association with Knee Pain and Function after Anterior Cruciate Ligament Reconstruction” defines self-efficacy as “. . . a judgment of a person’s potential ability to carry out a task rather than a measure of whether the task can be or is performed, and it can be described for any task” (Chmielewski, Zeppieri, Lentz, Tillman, Moser, Indelicato, & George, 2011, p. 1357). When looking at knee self-efficacy after an ACL surgery, the assessment is looking at “4 domains (daily activities, sports, and leisure activities, physical activities, and knee function in the future)” (p. 1357). Athletes that showed an improvement in self-efficacy twelve weeks post-surgery during the rehab process had reduced knee pain and better knee function when comparing it to an athlete that had lower self-efficacy (p.1362). According to Chmielewski Et. Al., these findings correlate to the fear-avoidance model (FAM), which helps to explain how musculoskeletal injuries can lead to chronic disabilities (p. 1356). The main idea behind this model is that after a musculoskeletal injury, in this case an ACL tear, an athlete will have either a low or elevated pain experience. A low pain experience means that the athlete does little pain catastrophizing and has a low fear of moving the knee or reinjuring the ACL. An elevated pain experience is just the opposite; the athlete has an increased rate of pain catastrophizing and a higher fear of moving and/or reinjuring the ACL. The model further explains that a low pain experience often leads to a normal recovery while an elevated pain experience can lead to chronic disability as an outcome (p. 1357).
In relating this back to self-efficacy, an athlete that tends to believe that they are capable of doing different tasks involving their knee post-surgery will have a lower pain experience and will likely start the rehabbing process earlier so that they gain increased knee function over an athlete that has a low self-efficacy. In other words, according to the model, it is not necessarily the actual strength or weakness of the repaired ACL that determines how the post-operative process will go, but the athlete’s belief as to how strong their repaired ACL is or will be through rehab.

Another psychological aspect that has gained attention over the past few years is the fear of re-injury affecting an athlete from returning-to-play after an ACL reconstruction. The article “Fear of Re-injury: A Hindrance for Returning to Sports after Anterior Cruciate Ligament Reconstruction” brings up the point that “psychological responses will always occur in physical trauma or injury and most athletes with injuries will experience negative emotions and lack of self-confidence because of reduced physical ability” (Kvist, Ek, Sporrstedt, & Good, 2004, p. 393). However, in the case of recovering from an ACL reconstruction, the fear of reinjuring the joint can actually cause athletes’ to struggle with recovery. In this study, of the 62 males and females that underwent ACL surgery, only “. . . 53% of the patients had returned to their pre-injury activity level 3-4 years after ACL reconstruction” (p. 395). Returning to pre-injury activity level means that the athlete remained in the sport they were playing and participated just as much and at the level they were at prior to surgery. In some cases, the athletes would return to sports, but they changed what sport that they were participating in; in most cases, it was switching from a contact sport to a non-contact sport. In addition, “24% reported” that the cause of them not returning to their original sport, not participating at pre-injury levels, or not participating in sports all together was due to fear of re-injury of the ACL (p. 395).
A similar study titled “Fear of Re-injury in People who have Returned to Sport Following Anterior Cruciate Ligament Reconstruction Surgery” notes that along with fear of re-injury, athletes also experienced anxiety and depression, all of which play a role in the return-to-play process (Arden, Taylor, Feller, & Webster, 2012, p. 488). Similar to the previous study, it defined fear of re-injury as “. . . [hesitating], holding back, giving less than maximal effort, being wary of injury-provoking situations and strapping the injured body part when participating in sport” (p. 488). All of these behaviors can contribute to an athlete not reaching their potential pre-injury level of sports participation because it becomes a barrier so to speak in the path of their recovery from rehab.

In addition to the overall fear of re-jury preventing athletes from returning to full functionality, it was also found that the time between injury and surgery played a role in the recovery process. Arden Et. Al, research explained that the time spans compared were within three months of injury and more than three months after injury. The participants that underwent surgery prior to the three-month deadline showed improved knee function, as well as a higher activity level in sport participation than did those that had surgery in more than three months after injury (Ardern, Taylor, Feller, & Webster, 2012, p. 489). Although it was not directly noted in the study, the time span prior to surgery may have played a role in the rate of recovery. Physiologically when an athlete waits for an extended amount of time to repair the ACL rupture, atrophy along with reduced neuromuscular control generally occurs; these two physiological factors can reduce knee function, thus reducing activity levels. However, psychologically the results suggested that the longer an athlete waits to have their ACL reconstructed, increased the amount of time that they felt the instability that the rupture caused. In addition, the more time that the athlete experienced their knee constantly giving out, appeared to add to their fear of re-

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4 Atrophy means a degeneration of muscle, tissue, or organs.
injury after surgery, making them much more likely not to return to pre-injury levels. In other words, in order to aid in reducing the significance of fear of re-injury, the athlete is better off receiving surgery as close to the injury date as possible. Ultimately, fear of re-injury can prevent athletes from performing to their potential and in some cases even stop them from participation all together.

An additional area in which fear of re-injury plays a role in return to play is in the type of graft an athlete receives. There are two types of ACL grafts commonly used, a patellar tendon and a hamstring tendon. The patellar tendon graft uses part of a person’s patellar tendon as well as bone from the patella and the tibia to reconstruct the ACL, whereas the Hamstring graft uses a section of the hamstring tendon to reconstruct the ACL. In some instances, it has been suggested that athletes with a patellar tendon graft have an increased fear of re-injury than an athlete with a hamstring graft. The study “Factors Affecting Return to Sports After Anterior Cruciate Ligament Reconstruction With Patellar Tendon and Hamstring Graft” found that of 100 patients, of which 50 had an patellar tendon graft and the other 50 had a hamstring graft, 88% of the athletes with patellar tendon grafts and 90% of the athletes with hamstring grafts were able to return to their sport with what researchers classified as a “normal or nearly normal” knee (Gobbi & Francisco, 2006, p. 1023). This suggests that statistically, neither graft is better or worse than the other is.

An additional study also compared the two grafts after two years post surgery to determine if there was an increased risk of tearing one graft over another. The study, from The American Journal of Sports Medicine examine a total of 235 participants at the two year follow up and found that there were “. . . 14 ligament disruptions, corresponding to an overall incidence of 6.0%. Of these 14 ligament disruptions, 7 were tears of the intact ACL in the contralateral\(^5\) knee (3.0%) and 7 were ruptures of the ACL graft (3.0%)” (Wright, Dunn, Amendola, Andrish, 2011).
Bergfeld, et. al. & Spindler, 2007, p. 1132). These results indicated that despite an athlete’s concern there is no difference in the risk of re-tearing the reconstructed ACL graft compared to tearing the opposite ACL; nor was there a difference between re-tearing the ACL based on the graft used. In other words, there is the same amount of risk of tearing a reconstructed ACL graft, both patellar and hamstring, then there is the athlete initially tearing their ACL. This study indicated that psychological impacts, specifically fear of re-injury tends to play a more significant role in the possibility of an athlete tearing an ACL graft then the fact that the ACL underwent reconstruction.

In comparing a concussion and an ACL injury, there are both similarities and differences between the psychological impacts that the injuries cause. “Emotional Response to Sport Concussion Compared to ACL Injury” examined the difference between the psychological effects of both of these injuries (Mainwaring, Bisschop, Comper, Richards, & Hutchinson, 2010, p. 589). There were three groups of student-athletes observed for the study twelve males and four females that were concussed, one male and six females with a confirmed ACL tear, and eight males and twenty females who were not injured. All participants partook in baseline emotional testing using the short version of the Profile of Mood States (POMS) test (p. 590). When an athlete became injured a post injury assessment was scheduled for them on day one, four, eight, fifteen, twenty-two, and day twenty-nine for both injuries. For each scheduled assessment the POMS was used, which tested the overall emotional disturbance for tension, depression, anger, vigor, fatigue, confusion, and self-esteem on a zero to four scale with four being extreme disturbance; once all of the data was collected, the researchers added a constant of 100 to the scores (p. 591). The results found that at baseline concussed athletes had an average score of 97.81, ACL athletes score was 105.43, and non-injured athletes score was 102.21. At four days
post injury, the concussed groups score was 116.69, 114.71 for the ACL group, and 106.36 for the non-injured. By seven days post-injury, the scores were 108.44, 110.86, and 100.89 respectfully and finally at fourteen days post-injury the scores were 100.69, 104.57, and 105.61 (p. 593).

In addition, the study also compared the depression scores form the POMS for the three groups. The researchers found that after the initial injury, concussed patients had a depressions score three times higher from baseline and ACL patients has a score seven times higher than baseline (p. 593-594). These scores indicated that concussed athletes might have more emotional disturbance initially, though they are not maintained; whereas, ACL injured athletes tend to maintain higher emotional disturbance, specifically with depression.

What all of this indicates is that even though a concussion is a brain injury that results in a direct impact to the area of the brain that controls psychological and cognitive functions that can last one to three months, it is ultimately the ACL tear in the knee that results in a greater and longer lasting psychological impact. In addition, an ACL tear is more likely to cause an athlete to not return to sport participation due to fear of re-injury, whereas no data indicates a fear of returning to sport after a concussion. In both cases, the brain has a major role in the process of treatment and rehabilitation and can be the overall reason as to why an athlete does not return to sport participation after an injury.
References


