PSYCHOLOGICAL ADJUSTMENT AND PSYCHOLOGICAL FLEXIBILITY FOLLOWING SPORT-RELATED CONCUSSION

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Abstract

Psychological Adjustment and Psychological Flexibility Following Sport-related Concussion

Emma Jean Pownall

An athlete's psychological response to a sports-related concussion may influence the success of recovery and return to play. This exploratory study explored how athletes psychologically respond to concussion, using Acceptance and Commitment Therapy to examine the role of psychological flexibility in recovery and return to play. Thirty athletes who experienced a concussion in the past three months completed online surveys measuring symptom severity, sport confidence, psychological strain, anxiety, depression, and psychological flexibility. Depression significantly predicted symptom severity (β = .615, p = .015). Psychological flexibility improved from pre- to post-return to play (p = 0.032, d = 0.45) and was correlated with greater confidence (pre: r = –0.451; post: r = –0.577) and lower psychological strain (r = 0.471). These findings suggest that increasing psychological flexibility may enhance recovery by reducing distress and building confidence. Return-to-play protocols should include psychological recovery measures.

Keywords: Injury Recovery, Return to Play, Psychological Flexibility,

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And most importantly, to my brave participants, thank you for contributing to my lifelong goal of helping people with concussions. Your willingness to share your experiences helps bring us closer to understanding the complexities of this invisible injury.

I will be forever grateful for this experience.

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List of Abbreviations

ACL-RSI – Anterior Cruciate Ligament Return to Sport Inventory

ACT – Acceptance and Commitment Therapy

APSQ – Athlete Psychological Strain Questionnaire

GAD-7 – General Anxiety Disorder

mTBI – Mild Traumatic Brain Injury

PHQ-9 – Patient Health Questionnaire 9

SCAT-5 – Sport Concussion Assessment Tool 5

SRC – Sports-Related Concussion

RTP – Return to Play

Research Approach and Organization of the Thesis

This study was initially conceptualized as a mixed-methods design. Incorporating both qualitative and quantitative research was proposed to provide a comprehensive and nuanced understanding of the research objectives and findings. The intention of the quantitative component was to provide statistical data to examine patterns and/or generalizability. The qualitative component was included to provide a voice to the participants and deeper insight and/or context. Interviews can help capture aspects that are missed in quantitative questionnaires. I had intended to integrate the two components to provide a dynamic and inclusive assessment of the research aims. Utilization of this approach would have combined the strengths of both quantitative and qualitative research to comprehensively examine the topic, integrate insightful understandings of the complex research problem, while providing depth and breadth. However, due to recruitment issues, only quantitative data was collected.

Thus, the thesis focuses on the quantitative component of the study, describing the aims, methods and results accordingly. For the reader's interest, the qualitative interview guide is appended (appendix N-Q).

Prologue

This reflexivity statement provides context for my involvement in concussion research and advocacy. The purpose is to highlight the deeply personal experiences that have shaped my dedication to improving concussion care and awareness. I aim to address the gaps in concussion research, education, and recovery. By sharing the journey and demonstrating the value of lived experiences, I hope to drive meaningful change in research and practice. Ultimately, my goal is to inspire broader conversations about concussion recovery and foster a more empathetic, informed, and effective approach to supporting those affected.

I sustained my first diagnosed concussion at 15 years of age when I crashed an ATV into a tree. I was knocked unconscious and airlifted to the hospital. I have since sustained three other concussions between the ages of 15 to 23. Reflecting upon my personal experience with concussions and knowing what I now know about signs, symptomology, experiences, and the recovery process, it is apparent to me that I had also sustained one other undiagnosed concussion before the age of 15 years old.

When I sustained my fourth concussion at the age of 18 in 2017, I was an aspiring ski racer on the Ontario Downhill Ski Team. The mechanism of injury was not due to sport but rather personal clumsiness. Due to the nature of an upcoming training camp, I was sent home for recovery. During recovery, I was cleared by a doctor who did not follow proper concussion protocol, but I was also personally negligent of the signs and symptoms that affected me every day. I ignored the symptoms and refrained from any activities that worsened them. I attempted to act as normally as possible to my parents, coaches, and teammates, all because I wanted to go to the next training camp. These

symptoms included constant headaches, increased emotional state, and fatigue. I was aware that they would worsen with physical activity and therefore avoided most physical strain before camp. These behaviours were driven by the aspiration to train and compete. However, underlying factors that drove these behaviours include external pressures and my closely tied identity to ski racing. At this point, I flew to Switzerland for training, and when I arrived, I was exposed to a change in altitude and air pressure; my signs and symptoms worsened, and it became impossible to function. Over five days, every morning I would begin dryland warm-up, but was unable to proceed to the slopes due to the increase in heart rate, resulting in nausea and exacerbation of symptoms. It felt embarrassing to have travelled that far and be five days into the trip, unable to properly function, all I wanted to do was touch snow. When I saw a doctor in the Swiss Alps, he thought I had contracted a virus during my travels and shut down the possibility of it being due to my past concussive event. It was not until the sixth day, when the team physiotherapist arrived, that she was able to confirm that what I was experiencing was due to the concussion. I was experiencing post-concussion symptoms, and the various changes in altitude and air pressure aggravated my symptoms. In this moment, I realized that if I had been more careful and spoken up about my symptoms that I would not have put myself in this situation. I spent the month in Switzerland attempting to recover so that I could meet the criteria to fly home. Having met the criteria, upon my return home, I encountered additional setbacks due to the flights and changes in air pressure once again.

Upon reflection during my recovery in Switzerland and years of injuries, I knew it was time to prioritize my brain health, and I retired from my ski racing career. Due to my experience with concussions, I knew that my goal in life was to change the concussion

landscape of Peterborough, Ontario, with the hopes of stretching that impact further. I had seen so many of my close friends struggle through concussion recovery with little direction and assistance. In addition, I aim to create the greatest amount of good for the greatest number of people, with the hope that others can receive the help they need to recover properly, feeling heard and understood in the process.

I quickly found myself taking any opportunity I could to involve myself in the concussion world further, engaging with others and their struggles, and seeking to expand my education on the topic. By 2021, I had been a volunteer with a growing concussion advocacy network for three years – HeadsupCAN and I am still heavily involved with them today. In the same year, 2021, I began volunteering for Peterborough Athletic Concussion Awareness (PACA), where I have directly implemented and seen positive change within the Peterborough community regarding concussions and sports culture.

Symptoms, Mood, Psychological Flexibility and Adjustment to Sport Following Concussive Injuries

Put yourself into the shoes of an 18-year-old soccer player. It is the biggest game of the season, and up until this point, soccer has been your whole world. Playing midfield, you chase down a loose ball, sprinting hard to get there before the other team, when suddenly, you collide with another player. You hit the ground hard, the back of your head slamming against the turf. For a second, everything is a blur, and you forget what your initial goal was. When you open your eyes, things feel... off.

The coach and athletic therapist come over quickly to see if you are okay. “Do you know what day it is?” someone asks. You answer, but the words come out slowly. “You’re out of the game,” the athletic therapist says. “I can still play,” you argue, but the pounding in your head says otherwise. With assistance on the sidelines, you find yourself frustrated by the decision. You are plagued by guilt as you sit on the bench watching your team struggle without you because you have always valued hardworking sportsmanship and showing up for your team. This decision to remove you from play conflicts with your core values; additionally, you feel a lack of autonomy. By the time the game is over, you’re feeling nauseous, and the stadium lights seem brighter than usual. By the time you get home, the symptoms are worse. Your head is throbbing, you are feeling exhausted, and it is hard to think straight.

The days drag on. The doctors say no screens, no school, and no physical activity. You are trying to rest, but it doesn’t feel as though you are getting better, which turns into a recurring negative thought. At first, your teammates text to check in. But after a while, the messages stop – you feel isolated. The team continues to play without you, and the

updates you hear only make you feel left out. Your parents don't get it. They tell you to "just relax," but it is not that simple. It feels hard to explain how you're feeling – foggy, frustrated, and stuck, but you feel as though no one truly understands what you're going through. The days drag on, and you wonder if you will ever feel normal again. Soccer has always been such a big part of your life and identity that you feel invisible and somehow without a purpose.

Your trainer mandates you to follow the Return-to-Play (RTP) protocol. You want to get back to playing and not worry about a sports progression. After waiting two weeks for your symptoms to get better, you have progressed through the second stage of RTP– light aerobic activity, and with no new or worsening symptoms, the doctor informs you that you can begin the next phase. You're excited but nervous. When you step on the field for the first time, everything feels different. After being cleared to play, you find yourself holding back in practice. You're scared to get hurt again. When someone runs towards you, you hesitate. Every fall, every bump makes your heart race. Instead of playing to win, you play carefully, avoiding risks. This new underlying fear surrounding re-injury is dictating how you play. After practice, you sit alone on the sidelines, which has now felt like an ongoing theme since the injury. Soccer doesn't feel the same, and you don't feel like the confident midfielder you once were. You still love the game, but now it feels like a threat to who you are. You know you'll need time to get back to how you used to play. For now, you focus on taking small steps and being present in the process.

Although underreported, I believe many athletes experience the scenario described above. There is currently a good clinical description of sport-related concussion

(SRC) covering the *objective* aspects of the injury, such as mechanism of injury, experienced signs and symptoms, a reliable distinction between typical or non-typical recovery, and an established RTP protocol. However, there are critical elements of the athlete's *subjective* experience that remain poorly understood. We do not know very much about the concussed athlete's emotional experience during recovery, such as how they experience the highs and lows of a recovery period or what psychological adaptations occur throughout the recovery period. Past research has highlighted gaps in understanding how athletes experience, interpret, and reflect on sports-related injuries while living with and recovering from them.

The current research aims to examine how concussed athletes process their recovery using the framework provided by Acceptance and Commitment Therapy (ACT) to examine psychological flexibility, mood, and overall adjustment to sport after injury. ACT has proven helpful in understanding coping and recovery in other health conditions, such as mild traumatic brain injuries (mTBI) (Faulkner et al., 2025). ACT provides a framework for examining both the social and cognitive aspects of the human experience, considering actions and internal experiences within the context of value-based, committed action. ACT aims to encourage people to take a step back and look at the big picture. This exploratory study will focus on the experiences of recovery and RTP. We have defined recovery as the whole sequence of events, from the time of the injury, inclusive of the RTP process, until clearance is obtained from a physician and the athlete successfully returns to gameplay.

This study hopes to contribute to a deeper understanding of the impact of concussions on an athlete's emotional well-being and factors that influence recovery and

return to play. This research may advance our comprehensive understanding of SRCs. Potentially providing valuable insights moving forward for medical professionals, coaches, and, more specifically, regarding the psychological well-being of athletes during recovery and RTP.

Literature Review

What is a concussion?

A concussion results from a sudden blow to the head, neck, or body that displaces the brain within the cerebrospinal fluid (Silverberg & Iverson, 2011). This displacement can disrupt normal brain functioning due to physiological changes and/or damage to the cells (Silverberg & Iverson, 2011). Concussions can result from physical trauma associated with falls, car accidents, and sports participation; the mechanism of injury is unique to each person/case (Mullally, 2017).

The diverse and complex nature of brain injuries, such as concussions, can involve symptoms from multiple clinical domains, with variations in symptom type, severity, and recovery time that are unique to everyone (Langdon et al., 2023). The signs and symptoms of concussion have been broken into six different clinical domains: (1) Somatic, (2) Physical Signs, (3) Balance Impairments, (4) Behavioural Changes, (5) Cognitive Impairments, and (6) Sleep/Wake Disturbances (McCrory et al., 2017a). Common signs and symptoms include headaches, dizziness, fatigue, confusion, depression, irritability, difficulty concentrating, sensitivity to light/noise, poor judgment, and eye movement problems (McCrory et al., 2017a; Ryan & Warden, 2003). While some people experience symptoms immediately, others may not experience symptoms up to 48 hours after a sustained concussion (McCrory et al., 2017a). The severity of the

injury can vary based on the location of the sustained trauma and psychological disruption to the brain (Danielli et al., 2023). In addition, the number of prior concussions can also influence the severity, with more sustained concussions typically resulting in a higher severity and a more complicated recovery (Creech et al., 2020a; Mez et al., 2017).

Recovery refers to the period during which an individual focuses on healing, both physically and mentally, from the initial injury. This includes rest, rehabilitation, and a gradual reintroduction to physical and cognitive activity under medical guidance and recommendations. Recovery can be measured by the resolution of symptoms, return to normal functioning, and clearance from a healthcare professional. Based on current research, the typical recovery period from a concussion is three to four weeks; at this point, both cognitive and physical signs/symptoms should resolve (Creech et al., 2020a).

While most individuals recover from a concussion within three to four weeks, some experience symptoms that persist beyond the typical recovery period (Eisenberg et al., 2014). Cancelliere et al. (2025) reported that nearly one in three adults who presented signs and symptoms of mTBI to the emergency department continued to report concussion symptoms three to six months later. People with persistent symptoms are diagnosed with a condition known as post-concussion syndrome (PCS). PCS is characterized by prolonged cognitive, physical, and emotional symptoms that can last for months or even years after the initial injury; significantly impacting daily functioning, school or work performance, and quality of life (Silverberg & Iverson, 2011), Factors such as the severity of the initial injury, history of prior concussions, and pre-existing psychological or neurological conditions can influence PCS (Cottle et al., 2017; Creech et al., 2020a).

The above description also applies to SRC, but SRC presents unique challenges due to the pressures inherent in athletic participation. Athletes may feel compelled to return to play before they are fully recovered, driven by internal motivations, fear of losing their role, or external expectations from coaches, teammates, or sport organizations. This pressure increases the risk of not only a recurring concussion but also other injuries, as unresolved symptoms can compromise physical coordination, reaction time, and decision-making. Premature return may also lead to reduced performance, loss of status, and psychological consequences such as frustration, anxiety, or identity disruption, factors that can create a cycle of reinjury and delayed recovery.

Second Impact Syndrome (SIS) is a rare but catastrophic condition that emphasizes the importance of the proper progression through the RTP protocol. SIS occurs when an individual sustains a second head injury before symptoms from an initial concussion have fully resolved, leading to rapid edema, brain herniation, and death (Bey & Ostick, 2009).

Owing to the aforementioned risk elements, the RTP protocol was developed to return athletes to sport safely. The RTP protocol is a criterion-based progression plan designed to aid the transition back to active participation in sport after concussion, with an emphasis on the recovery process that ensures symptoms have resolved before athletes re-engage in sport.

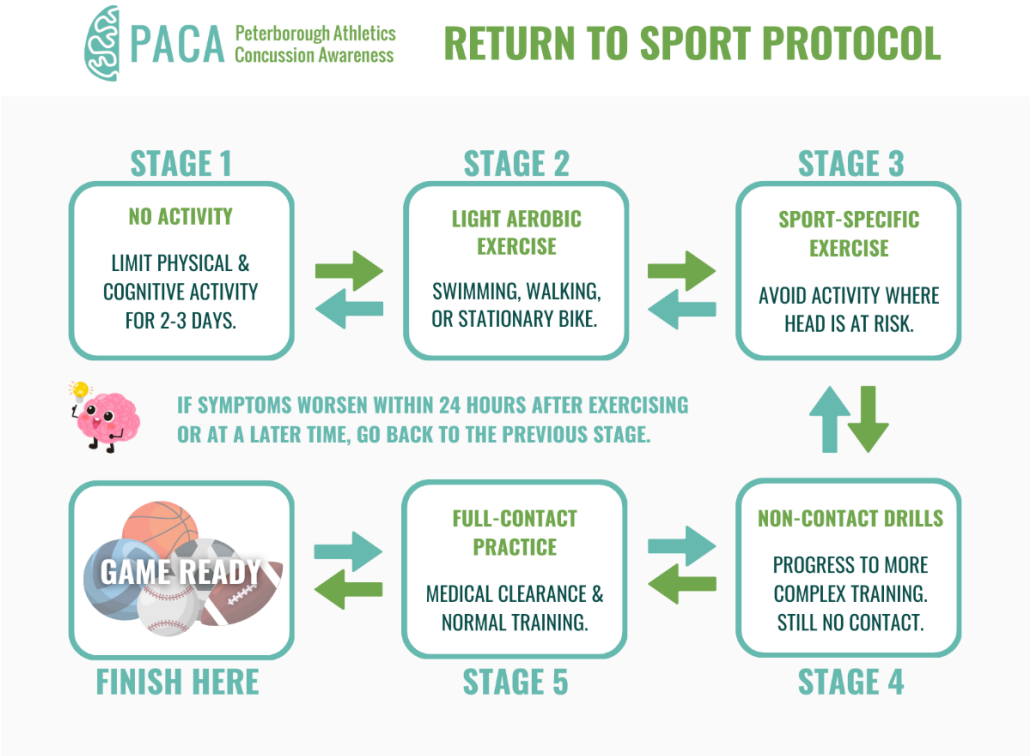
The RTP protocol for returning is broken down into six stages that guide athletes through a progressive load return (Appendix A) (Parachute Canada, 2017)[1]. The protocol

[1] Parachute Canada is a national charity dedicated to preventing serious injuries through research, education, and advocacy. It focuses on issues like sports injuries, fall prevention, and concussions, providing resources and programs to promote safety across various groups.

begins immediately after the concussion is diagnosed. Athletes should remain in each stage for at least 24 hours, with the exception of stage 3. Athletes only progress to the next stage if no new or worsening symptoms manifest during the activities prescribed in the current stage. Athletes are advised to remain in their current stage if new symptoms develop or existing symptoms worsen. Athletes transition through a gradual increase of physical load as it pertains to their sport. Some sports organizations mandate this protocol to ensure athletes do not return to sport too early, risking long-term issues. However, there is little monitoring to ensure adherence and few consequences for those who do not follow.

Figure 1

Return to Play Protocol



Note. Permission of use obtained from Peterborough Athletic Concussion Awareness.

The Unique Experience of Recovery from Sport-Related Concussion

Recovery from sport-related concussions is a deeply personal experience within a social context. Concussion injury is naturally stressful to athletes and can affect mood and confidence (McCrory et al., 2017a). Whether conscious or subconscious, participation in sport is typically marked by the acknowledgement of potential injury and re-injury. Athletes may also exhibit a unique disposition regarding injury and RTP. This may include increased risk-taking, strong ties to sport, and a sport culture that encourages playing through the pain. This mindset, while beneficial for athletic success, can hinder adaptation during recovery by promoting denial of symptoms, resistance to rest, or premature return to play. The risk of injury is due to factors such as the physical nature of the activity, competitiveness, and the unpredictability of sport (Chen et al., 2019; Mayer et al., 2020). Recovering from a SRC can be especially challenging because the injury is often invisible and doesn't follow a clear or predictable timeline. Along with the physical risks of playing sports, athletes may also deal with difficult psychological challenges during recovery.

Similar to other injuries, a concussion is a stressor because of the accompanying symptoms, loss of function, and removal from sport. For example, athletes may experience headaches, dizziness, sensitivity to light or noise, and difficulty concentrating. Symptoms that could interfere with athletic performance. In SRCs, this strain may manifest as mood disturbances, reduced motivation, and emotional dysregulation. Evidence suggests that dealing with a concussion has an adverse effect on athletes' mood. Sáez De Heredia et al. (2004) found that following an athletic injury, the athlete experiences declining mood until approximately halfway through the recovery period.

When the athlete is cleared to play, their mood begins to project upwards in a positive manner.

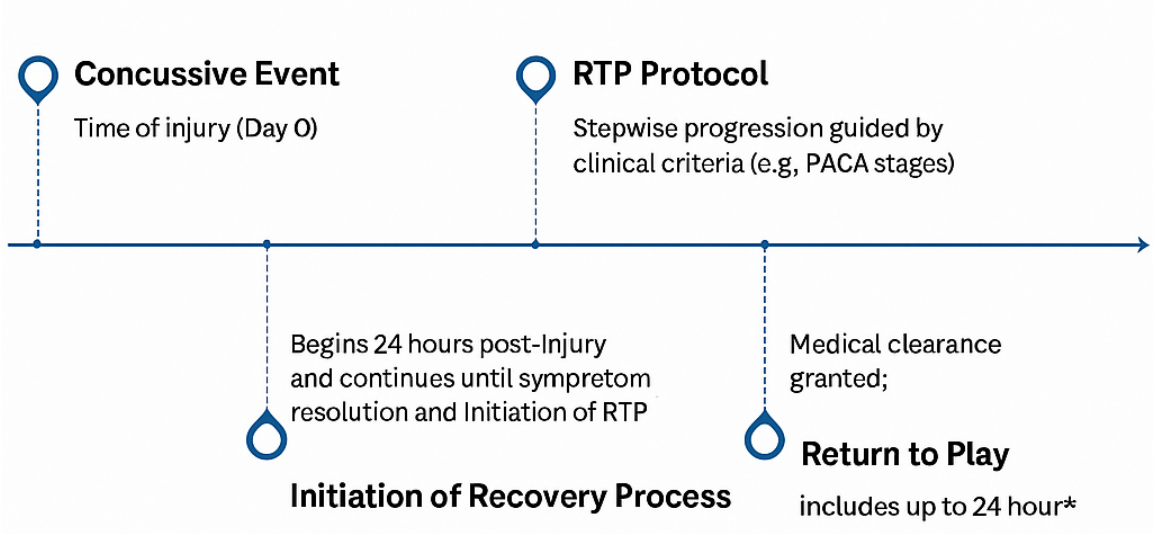
This pattern has also been observed in SRC research, wherein researchers found that mood worsens following a concussion but improves upon RTP (Hammer et al., 2021). This negative mental shift is an essential consideration because of the possible influence it places on the rate of recovery/recovery process. Overall, while the sources do not offer conclusive evidence that mood directly causes a prolonged concussion recovery, they do suggest a strong link between psychological factors and the recovery process. This means that the psychological well-being of an athlete, such as negative mood, pre-existing mental health conditions, fear of reinjury, and negative expectations, can contribute to increased symptom burden, decreased engagement in rehabilitation, and potentially prolonged recovery times.

The athlete's confidence is also understandably shaken following a concussion. In a related way, athletes may also become fearful about RTP and generally more anxious. Figure 2 illustrates the critical stages of an athlete's concussion recovery journey, from injury through medical clearance for return to play. The RTP process refers to the full recovery sequence starting from the concussive event and ending with medical clearance. Within this larger process, the RTP protocol represents the gradual, step-by-step progression outlined in clinical guidelines (e.g., PACA framework), typically initiated after symptom resolution and before full sport reintegration. "Return to Play" is also used broadly to describe the athlete's overall journey and experience throughout the concussion recovery process. Athletes recovering from a concussion also often experience a significant drop in confidence and an increase in anxiety, particularly

around the RTP process (Kontos et al., 2012). These psychological responses have been widely studied in the context of other injuries, such as ACL reconstruction surgery and RTP. For example, Webster et al. (2018) used the ACL-RSI scale to assess psychological readiness to return to sport, focusing on confidence, emotions, and risk appraisal. The findings showed that athletes with higher self-reported knee function, regardless of objective clinical assessments, also reported greater psychological readiness to RTP. This highlights the importance of subjective belief in recovery over objective function and emphasizes the predictive power of self-perception. However, the ACL-RSI may not fully capture athletes' fear of reinjury, which overlaps with anxiety and could also influence RTP outcomes. These same concerns—confidence in function and anxiety about reinjury—are equally relevant in the context of SRCs. An athlete's perceptions of cognitive function and fear of sustaining another concussion may similarly impact psychological readiness, symptom reporting, and rehabilitation adherence. Thus, while tools like the ACL-RSI offer practical frameworks, a more nuanced and contextualized approach may be needed to understand and address the psychological dimensions of concussion recovery fully.

Figure 2

Timeframe of Return-to-Play (RTP) and Recovery Process



Athletes often strongly identify with their sport as the center of their lives and as a key part of their self-concept and social identity. Athletic identity refers to the degree to which an athlete identifies with their sport, ultimately integrating into their psychological perceptions of self (Dean, 2019). After years of participation, athletes may have deeply rooted themselves in their sport, becoming a central part of who they are and their daily routine. When an individual's sense of self is deeply connected to their athletic role, injury can lead to a significant disruption to their self-concept. This identity disruption is often compounded by the loss of daily structure, social atmosphere and personal ties that are embedded in a sports environment. Removal from play poses a threat to an athlete's identity, particularly for those whose identity and social atmosphere are closely entwined with their sport. Athletes may feel they are losing a part of who they are, especially when sidelined from the very activity that reinforces their self-worth. A concussion can trigger a disruption in their ability to participate in their sport and lead to a potential loss of identity (Todd et al., 2018). This disruption often results in psychological consequences

that include feelings of anxiety, depression, and contribute to isolation (Todd et al., 2018). Loftin, Covassin, & Baez (2023) identified that athletes who maintain a strong athletic identity may perceive injury as a direct threat and may evoke feelings of helplessness and frustration. If the injury is viewed as a threat to self, the athletes may engage in nonproductive behavioural responses, for example, shying away from reporting their injury or underreporting symptoms. This identification creates unique pressures to return to play quickly, manage pain in silence, and minimize the perceived impact of injury.

With competition comes competitiveness. The nature of many sports activities involves intentional or incidental physical contact, increasing the risk of concussions. In many sports, competition involves physical contact, either intentional (collision sports) or incidental. With opposing competitors increasing the risk of injury. This may be through tackling in football, body checking in hockey, or direct blows in boxing. The intense physicality of these sports predisposes athletes to various injuries, including head injuries. Collision sports, where intentional physical impact is a component of play, carries the highest risk of injuries, including head trauma and concussions (McCrory et al., 2017, Watanabe., 2022 & Yrondi et al., 2017). Competitiveness is an underlying factor in sports that drives the players with intensity and may result in athletes making riskier decisions during gameplay (Chen et al., 2019). Competitive play is a valued trait, enhancing performance and may also result in players pushing their bodies to their limits, playing more aggressively, or exposing themselves to injury for the sake of winning. When combined with the lack of visible symptoms, athletes may feel pressured to continue playing. Athletes' primary social spheres—coaches, teammates, and fans—may

also reinforce a "play through it" culture, due to the competitive atmosphere, intensifying the challenge of managing a concussion effectively. These factors, along with the desire to compete, create a complex psychological landscape that makes the recommended recovery (RTP protocol) particularly difficult to adhere to.

Concussions present unique challenges because of their non-linear recovery trajectory and invisibility. Unlike physical injuries, such as a fractured leg, which typically has a predictable healing timeline and visible markers, concussion signs and symptoms are invisible and can fluctuate, contributing to the unpredictability of the condition and lengthening the time spent in recovery (Rice et al., 2019). Due to this lack of clarity surrounding timelines and recovery, athletes may feel inclined to resume competition even if symptoms persist. The unpredictable duration of recovery may trigger feelings of uncertainty, frustration, invalidation, and anxiety about losing one's position on the team, disappointing others, or being perceived as weak. Due to a lack of visible markers of injury, athletes who "look fine" may feel pressured to play or return to play prematurely, while internally managing cognitive symptoms, emotional dysregulation, and physical discomfort. A non-linear injury, unpredictable symptoms and recovery causing uncertainty to compound the removal from the daily structure of play, loss of the team/social environment, and contribute to feelings of isolation (Cassilo & Sanderson, 2019; Rice et al., 2020).

Loss of social network, with accompanying isolation and loss of support, is another aspect that may not be unique to concussions. Still, when combined with the other issues surrounding recovery, it makes for a challenging dynamic. Athletes may experience a sense of isolation or disconnection from teammates, coaches, and the

community that once reinforced their role. Isolation may be due to the physical barrier of being removed from their team or may include self-evoked isolation due to a lack of understanding. Isolation during concussion recovery has been known to increase the risk of anxiety and depression (Cassilo & Sanderson, 2019). This uncertainty may add to the potential strain on the athlete surrounding maintaining a position on their team, recovering in time for a big game, or lead to questioning surrounding readiness.

While this social context typically involves teammates, coaches, and family that may or may not provide meaningful support, recovery can also be a time of significant psychological strain for the athlete. Athletes function in a culture that typically emphasizes toughness and pushing through pain. “No pain, no gain,” as the saying goes. These norms may be celebrated but pose an issue during concussion recovery. Even the most resilient athletes are faced with the challenge of an unpredictable injury and recovery timelines that are inherent to concussions. For those with a strong tie to their sport, removal from play can feel like a direct threat to their concept of self (Dean, 2019; Loftin et al., 2023). Overall, individuals recovering from a concussion may experience feelings of anxiety, depression, isolation, and helplessness. These feelings may be heightened if they feel invalidated or misunderstood due to the nature of an invisible injury (Todd et al., 2018).

To summarize, concussion recovery in athletes depends on a range of factors, including both physiological and psychological components (Clement et al., 2015; Kotler et al., 2022). While recent research emphasizes returning individuals to daily functioning (Todd et al., 2018), further exploration is needed to understand the subjective experience of recovery. Although physical recovery is a primary focus on RTP protocols,

psychological readiness is often overlooked. Athletes face a nonlinear and unpredictable recovery process that can heighten anxiety and reinforce negative moods. Common emotional responses include frustration, helplessness, and isolation, particularly when separation from teammates and coaches disrupts their social connections (Cassilo & Sanderson, 2019; Rice et al., 2020).

Additionally, fear of appearing weak or letting others down may lead to underreporting of symptoms, delaying appropriate care (Gouttebarge et al., 2021; Doolan et al., 2013). Alongside physical and cognitive challenges, athletes also contend with psychological strain, pressure to return, and threats to their athletic identity. Psychological flexibility—the ability to adapt to situational demands, shift perspectives, and maintain engagement in valued activities despite adversity—can help athletes navigate the uncertainty and emotional strain of concussion recovery (Kashdan & Rottenberg, 2010)

Psychological Flexibility: A Framework for Understanding Recovery

To address the various challenges with SRC, the primary researcher used the theoretical framework of Acceptance and Commitment Therapy (ACT) as a basis for understanding the response to concussive injuries, focusing on recovery and RTP. ACT is a behavioural change approach to things beyond our control, focusing on commitment to actions, centred around psychological flexibility. Mahoney and Hanrahan (2011) define psychological flexibility as the ability to connect with present-moment awareness to produce and maintain a valued behaviour. In other words, it focuses on having people be aware of their discomfort and stress and take action towards their personal goals and values. ACT is often utilized in a therapeutic setting, wherein it is targeted towards

behavioural change to live a more meaningful life, aligned with core values. The overarching aim of ACT is to obtain psychological flexibility. The ACT framework is useful in a variety of settings and situations, such as being in touch with self when making big decisions, being open to new experiences, producing a targeted behaviour or living in alignment with your values (Engle & Follette, 2018). Past research has demonstrated that the opposite of psychological flexibility – psychological inflexibility is correlated to aspects of depression, anxiety, and stress (Doorley et al., 2020).

These findings suggest that psychological flexibility—the core process targeted in ACT—may offer a valuable framework for addressing the mental and emotional challenges associated with injury recovery. In the context of sport, psychological flexibility provides insight into how athletes cope with the complex and often unpredictable nature of concussion recovery and RTP. Concussion recovery can be uniquely challenging for athletes due to performance pressures, identity disruption, and uncertainty around symptom progression/RTP. Research has shown that athletes with higher levels of psychological flexibility tend to experience faster and more adaptive recoveries (Gross et al., 2018). ACT is built on six core principles that contribute to psychological flexibility, presenting a promising framework for understanding athlete well-being during rehabilitation and RTP.

Core Principles of ACT

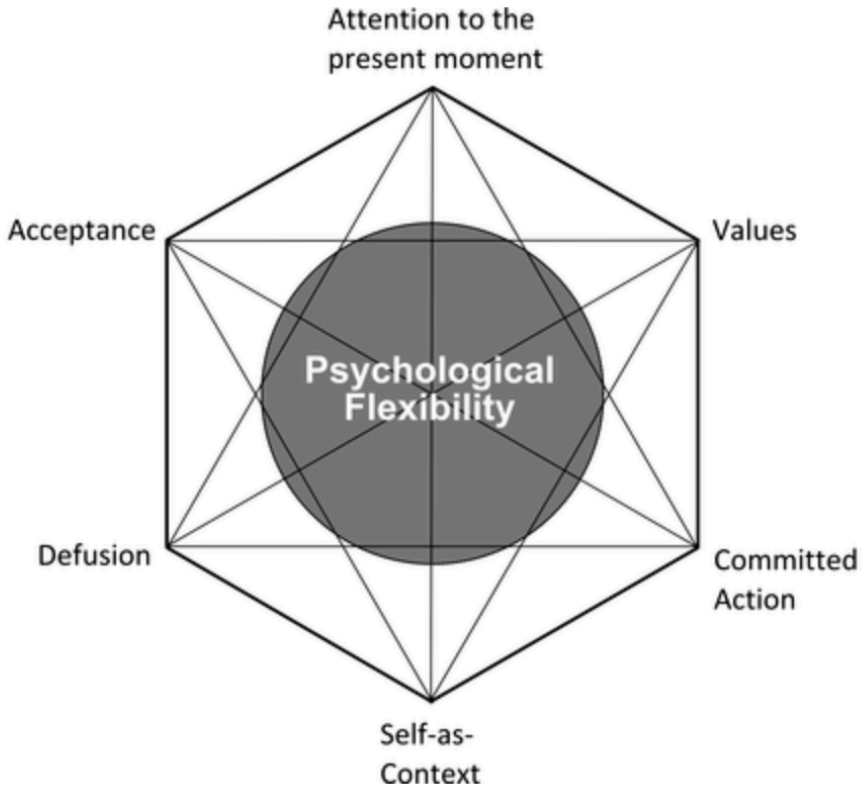
ACT relies on six core principles that contribute to psychological flexibility: (1) Acceptance, (2) Defusion, (3) Mindfulness, (4) Self as Context, (5) Values, and (6) Committed Action (Figure 2). All core principles contribute to psychological flexibility, are interactive and may be operating to greater or lesser extents at different recovery

points. The extent to which they contribute may vary depending on the situation. For example, if an athlete values their health and wellness, living in alignment with and committing their action towards these values would be more important at this time than defusion or self as context. Whereas an athlete struggling with symptom burden and the pressures to play may get caught up in cognitive defusion, overthinking what others want of them and take away from the present moment awareness of their symptoms. However, all are equally important.

Mahoney and Hanrahan. 2011 define the core principles. Acceptance refers to the individual acknowledging their thoughts and feelings towards the situation without judgment. Cognitive defusion involves learning to view thoughts as mental events rather than absolute truths, which helps to reduce the impact of those thoughts on behaviours. Mindfulness, also referred to as Present-Moment Awareness, helps individuals to be more present and aware of their thoughts and emotions. Self-as-context is the "observing self" that allows the individual to observe their thoughts and emotions without being fused to them. Values refer to what an individual considers important and involve setting meaningful and attainable goals. Committed action refers to the behaviours and steps an individual takes towards achieving their values. Individuals with greater self-awareness are more adept at self-observation and exhibit higher psychological flexibility. Moreover, these principles can also function in conjunction. For example, involving committed action and values, together, may also be known as being engaged with life's experiences. Another instance of the values working together is mindfulness and self-as-context; this may be referred to as being aware.

Figure 3

Psychological Flexibility Diagram



These core principles can influence, promote, or diminish psychological flexibility depending on the context of use. Studies have identified the beneficial use of ACT in understanding recovery from depression, chronic pain, anxiety, and post-traumatic stress disorder (Doorley et al., 2020). In the context of chronic pain, ACT encourages patients to accept pain rather than control it, leading to improvements in functioning and quality of life (McCracken & Vowles, 2014). ACT has also shown promising outcomes in the treatment of anxiety disorders, such as generalized anxiety disorder and social anxiety, by promoting psychological flexibility and reducing avoidance behaviours (Arch et al., 2012). Emerging research has also explored the use of

ACT in populations with mTBI, particularly those experiencing persistent PCS. Whiting et al. (2020) found that ACT interventions improved psychological flexibility, reduced symptom distress, and enhanced quality of life in veterans with chronic PCS. Similarly, Faulkner et al. (2025) demonstrated that ACT was associated with reductions in post-concussive symptoms and improved emotional well-being among individuals with prolonged recovery. These findings suggest ACT may offer a valuable framework for addressing the psychological components of mTBI recovery, particularly in individuals facing long-term challenges with symptom persistence and identity disruption. Within the context of concussion recovery and RTP, high levels of psychological flexibility could pose a beneficial measure due to the potential complications the injury can have. It is important to consider both sides of psychological flexibility and inflexibility as they contribute to an athlete's overall function.

Return to Play Viewed Through a Psychological Flexibility Lens

The ACT framework offers a meaningful way to understand how athletes navigate the challenges of concussion recovery and the RTP process. ACT emphasizes how athletes relate to their internal experience and how this impacts their recovery behaviours. Conversely, psychological inflexibility may manifest when athletes become entangled in negative thoughts or avoid difficult emotions, potentially delaying recovery or prompting premature RTP decisions. Each of the six ACT processes supports flexibility but has a counterpart that can hinder progress.

Acceptance vs. Avoidance

Athletes who struggle to accept the problematic thoughts and feelings that arise during recovery, such as fear of losing their position, anxiety about being left behind, or

frustration with the slow pace of progress and uncertain RTP timelines, may resist acknowledging symptoms, rush the RTP process, or disengage from treatment recommendations. These emotionally charged internal experiences that lead to avoidance of symptoms can result in impulsive decisions that ultimately prolong the recovery process. Acceptance, in this context, involves recognizing these thoughts and feelings without judgment and refraining from trying to suppress or avoid them. An athlete may not like being sidelined, but by allowing thoughts like *"*I am falling behind" or feelings of frustration and fear to exist without acting on them, they create space to make values-driven choices, such as prioritizing long-term health by adhering to the RTP protocol. Given the elevated risks associated with premature return, including prolonged symptoms or SIS, learning to accept the internal discomfort that comes with recovery is critical for both safety and performance.

Cognitive Defusion vs. Cognitive Fusion

Mindset and an athlete's perceptions of their cognitive function play significant roles in psychological readiness to RTP following a concussion. Athletes often experience fear and anxiety about reinjury, fear of missing out (FOMO), external pressures, and maintaining team positions (Kotler et al., 2022; Mayer et al., 2020; Tjong et al., 2017; Watanabe, 2022). Cognitive fusion occurs when athletes become entangled with these anxious thoughts, treating them as facts, leading to avoidance behaviours or impulsive decisions. In simple terms, the athlete can be influenced by their thoughts and feelings to behave in non-adaptive ways. Conversely, cognitive defusion helps athletes notice thoughts as just thoughts—transient and non-directive—allowing them to make value-consistent choices despite the presence of fear/distress.

Corwin et al. (2014) found that athletes who were less fearful exhibited better adherence to their RTP plans and recovered more quickly. In addition, relating back to aspects of confidence, Webster et al. (2018) found that athletes' beliefs about their function were stronger predictors of psychological readiness than objective physical assessments. This supports that when athletes' internal thoughts and feelings are less fearful and evoke stronger self-efficacy beliefs, they are better prepared for sport. For example, Gardner and Moore (2017) demonstrated that using mindfulness and defusion-based interventions with athletes reduced performance anxiety and improved emotional regulation during return-to-competition phases post injury. Addressing cognitive fusion through defusion strategies can therefore improve RTP outcomes, ensuring that fear of reinjury and other emotionally charged thoughts are acknowledged without dictating behaviour. By learning to "unhook" from distressing thoughts, such as "I'll get hurt again," athletes were better able to stay grounded in the present moment and make value-consistent choices that supported safe and effective recovery.

Present Moment Awareness (Mindfulness) vs. Disconnection

Athletes recovering from a concussion often report a sense of disconnection from their sport, teammates, and personal identity. Removal from play can lead to feelings of isolation, frustration, and a diminished sense of purpose (Kotler et al., 2022; Mayer et al., 2020; Tjong et al., 2017). These challenges may be amplified by the invisible nature of concussions, which can result in a lack of external validation from peers or coaches. When athletes become caught up in thoughts about what has been lost or uncertainties about the future, they may become disconnected from the present moment. Developing present-moment awareness helps counteract this tendency by grounding athletes in what

is within their immediate control. Hammer et al. (2021) noted that mood tends to improve as athletes approach return-to-play (RTP), but engaging in present-moment practices may accelerate emotional recovery. Athletes who foster present awareness are better equipped to manage uncertainty, sustain social connections, and participate in rehabilitation with greater focus and intention.

Mindfulness, or present-moment awareness, enables athletes to observe the connection between their thoughts, emotions, urges, physical sensations, and behavioural responses. In the absence of mindfulness, athletes may miss important emotional cues, such as feeling anxious about securing their position on a team. They may consequently rush their RTP or misread normal emotional fluctuations as signs of weakness. Mindfulness attempts to enhance awareness of how internal and external factors. For example, it may aid in the recognition of sports-related identity loss and the impact of removal from play on emotional well-being. Mindfulness can help athletes to acknowledge their thoughts and feelings without being controlled by them, promoting more deliberate decisions regarding rest, social interaction, and self-care. Integrating mindfulness into the recovery process may help reduce psychological distress, support emotional regulation, and minimize impulsive or risk-laden choices during RTP.

Self-as-Context vs. Self-as-Content

Athletes who over-identify with negative thoughts—viewing themselves through a self-as-content lens (e.g., “I’m useless because I’m injured”) may experience prolonged psychological distress. In contrast, self-as-context provides a broader perspective, enabling athletes to observe the situation without being overly attached to it. Prior concussion experiences may influence these perceptions. For example, athletes with

successful past recoveries may approach the process with confidence, while those with negative experiences or exposure to skeptical teammates may become resistant or disengaged. Athletes who exhibit self-as-context recognize that while challenges exist, the challenges or the negative thoughts during recovery do not determine who they are. Self-as-context allows them to draw on a successful history as evidence of their capacity for resilience, rather than as pressure to recover perfectly. Whereas those operating from a self-as-content perspective may become overly identified with past negative experiences or external narratives. Interpreting these as evidence of personal inadequacy or future failure.

Values vs. Lack of Clarity

Values serve as guiding principles that direct athletes' actions and choices during recovery. Rehabilitation aligned with personal values, such as prioritizing long-term health, contributing to the team, or achieving personal growth, can enhance motivation and adherence. In contrast, a lack of clarity in values may lead to frustration with oneself, confusion, or premature RTP driven by external pressures, such as the importance of the game or team expectations (Kotler et al., 2022). Values serve as guiding principles that direct athletes' actions and choices during recovery. Rehabilitation aligned with personal values, such as prioritizing long-term health, contributing to the team, or achieving personal growth, can enhance motivation and adherence.

In contrast, a lack of clarity in values may lead to frustration, confusion, or premature RTP driven by external pressures like the importance of the game or team expectations (Kotler et al., 2022). When focused on performance, athletes may lose perspective in the face of injury, prioritizing short-term success or team obligations over

their long-term health and well-being. This internal conflict reflects a shift away from core values such as self-care or sustainability. It can result in decisions that delay recovery or increase the risk of re-injury. Concussions, often minimized due to their invisibility, heighten this challenge. Establishing clear values early in rehabilitation enables athletes to navigate competing demands, make informed decisions, and sustain commitment to health-oriented goals even when short-term desires or pressures arise over long-term health and well-being.

Committed Action vs. Inaction or Impulsivity

Committed action involves taking purposeful steps aligned with recovery goals despite discomfort or discouragement. Inaction or impulsivity can hinder progress; athletes may rush to RTP to satisfy external pressures or withdraw from rehabilitation due to fear, frustration, or negative emotional experiences (Mayer et al., 2020). Concussions complicate this further due to stigma, uncertainty, and the invisible nature of the injury. Emotional experiences and past recovery histories play a significant role: those who previously rushed RTP and suffered setbacks may approach future recoveries with hesitation, while others may impulsively disregard symptoms to reclaim athletic identity. Highlighting how emotional responses influence current behaviour ensures athletes remain committed to safe and effective recovery plans.

ACT can help us understand the recovery process after a concussion, especially when it comes to getting back to play. By focusing on psychological flexibility and using the core principles of ACT, we can attempt to understand how athletes perceive and act upon the different challenges faced during recovery. If put into proper practice, these principles could guide athletes in building emotional strength to push through the hurdles

of concussion recovery. By examining the impact of psychological flexibility on recovery, we can better support athletes and ensure they are both physically and mentally prepared to return to their sport safely and effectively.

The Current Study

Understandably, for safety reasons, physical recovery has been a primary focus in SRC practice and research. However, athletes experience recovery on both physical and psychological levels, which is also influenced by individual characteristics and social dimensions unique to the athlete and their athletic environment. Research has been modest in understanding psychological recovery from SRC and limited in investigating models that might help understand and promote athlete recovery. The psychological flexibility framework offered by ACT could provide tools for researchers focused on understanding the psychological challenges of concussion recovery and the RTP process for athletes.

As ACT has not previously been investigated in the context of concussion, the current study aims to explore the inter-relationships between concussion symptoms, emotional and psychological adaptation (stress, mood, confidence) and psychological flexibility. To achieve this aim, the study addresses the following research questions.

1. What are the relationships between concussion symptoms and emotional/psychological adaptation as operationalized by depression, anxiety, and psychological strain following SRC?
2. What are the relationships between confidence and emotional/psychological adaptations as operationalized by depression, anxiety, and psychological strain following SRC?

3. What are the relationships between emotional/psychological responses (e.g., depression, anxiety, psychological strain), confidence, and symptom experience (symptom total/severity) and time to return to play?
4. What is the relationship between psychological flexibility, as operationalized by the components of acceptance and willingness in the ACT framework and emotional and psychological responses to recovery?

Understanding the different dynamics of mood and symptoms as they affect psychological flexibility in an athlete's experience throughout the RTP and recovery from a concussive injury is imperative for further understanding the complexities of an SRC. As an exploratory study, by examining psychological flexibility, alongside concussion symptoms and psychological adaptation, this study has the potential to identify areas of worthy of future research.

Research Methods

Design

This is an exploratory, cross-sectional, retrospective study. Using self-reported questionnaires, participants reflected on past experiences (e.g., concussion symptoms, psychological states during recovery), collected at one point in time from each participant. Prior to data collection, all participants signed consent forms approved by the Trent University Research Ethics Board (#28853).

Recruitment and Sampling

Participants were primarily recruited via word of mouth and social media. The primary researcher used a graphic (Appendix B) to share the study information on Facebook, Instagram, and X. Interested athletes scanned the QR code, taking them directly to the anonymous survey.

To participate in the study, all participants needed to be an athlete competing at a competitive level. “Competitive level” was left to the subjectivity of the participants. In addition, all participants need to have sustained a concussion that removed them from play, and subsequently participated in a RTP protocol within the last three months. All participants should be otherwise considered healthy, meaning that they had not been diagnosed with a short or long-term condition that could affect their participation in daily life and free of neurological dysfunction that was not caused by the concussion. No gender or sex exclusions occurred.

Materials

Participants completed a battery of questionnaires designed to assess their demographic and athletic history, concussion symptoms, psychological well-being, and

psychological flexibility. The materials included: the Athletic and Injury Questionnaire (Appendix C). This questionnaire collected demographic information, sports participation, and injury history. Following this questionnaire, they completed the Sport Concussion Assessment Tool – 5 (SCAT-5), ACL-RSI (Adapted), Sport Mental Health Assessment Tool – 1 (SMHAT-1), The Psychological Flexibility in Sport Questionnaire (PFSQ).

Sport Concussion Assessment Tool – 5 (SCAT-5)

The Sport Concussion Assessment Tool – Version 5 (SCAT5), is the dominant screening tool used for identifying and diagnosing concussion symptoms (McCrory et al., 2017). By using the SCAT-5 to ask athletes about their symptom experience during recovery in a low-stakes environment through anonymous online surveys, we can ensure athletes feel safe to report and can also assess how their symptoms relate to aspects of psychological flexibility.

Concussion symptom experience was measured using the Sport Concussion Assessment Tool – 5 (SCAT-5) (Appendix D). The SCAT-5 is a self-report 22-item, seven-point Likert Scale (0 = no symptom to 6 = severe) that provides measures of both number and severity of symptoms experienced. Assessing concussion symptoms such as “Headache”, “Dizziness”, and “Nausea”. The SCAT5 demonstrates moderate to high internal consistency, particularly within the symptom evaluation component (Chin et al., 2016). It shows good construct validity, distinguishing between concussed and non-concussed individuals in the acute phase (Echemendia et al., 2017). We acknowledge that retrospective symptom reports are subject to participant memory.

Anterior Cruciate Ligament Reconstruction Surgery Inventory (ACL-RSI) –Adapted by Pownall, Brown, and O'Hagan

Psychological readiness to return to sport was measured using the ACL-RSI-Adapted (Pownall, Brown, and O'Hagan, nd). Confidence reflects an athlete's belief in their ability to perform without reinjury, while readiness captures their overall psychological preparedness, including confidence, emotions, and perceived risk toward returning to sport The ACL-RSI is a self-report 12-item, 10-point Likert scale (0 = not at all to 100 = completely). It evaluates factors such as confidence in knee stability, fear of re-injury, and motivation to return to play. Ask participants to rate statements such as, "Are you confident that you can perform well at your sport without concern for your knee?". The original ACL-RSI is a valid and reliable measure of readiness to return to sport after an ACL injury (Webster et al., 2018). The researchers also noted that the ACL-RSI scale may lack elements that need to further address fear of reinjury, which can also be defined as anxiety towards reinjury. To address this possible limitation, the use of the Generalized Anxiety Disorder Scale-7 (GAD-7) through the SMHAT-1 can aid in bridging the gap. These elements of understanding self-reported confidence when contextualized to the injured body part and exploring anxiety towards reinjury coincide with ACT, SRC and recovery.

This survey was contextualized to concussion (ACL-RSI Adapted). The survey maintained the same structure; a self-report 12-item, 10-point Likert scale (0 = not at all to 100 = completely), but aimed to evaluate confidence in their head as the injury focus. For example, the researchers changed, "Are you confident that you can perform well at your sport without concern for your knee?" to "Are you confident that you can perform

well at your sport without concern for your head?". See Appendix E for a complete contextualization of the survey.

Sport Mental Health Assessment Tool – 1 (SMHAT-1)

In response to these concerns, the International Olympic Committee (IOC) developed the Sport Mental Health Assessment Tool (SMHAT-1) to assess and identify mental health symptoms and disorders in athletes through quantitative measures (Gouttebarge et al., 2021). The SMHAT-1 incorporates several existing, validated screening questionnaires to evaluate aspects of an athlete's mental health. Psychological strain was measured using the Athlete Psychological Strain Questionnaire (APSQ). This tool focuses on psychological strain, assessing stress, coping, and emotional regulation in the context of sports. Depression was measured using the Patient Health Questionnaire-9 (PHQ-9). This tool screens for symptoms of depression, such as low mood, loss of interest, and fatigue, providing insight into the severity of depressive symptoms. Anxiety was measured using the Generalized Anxiety Disorder Scale-7 (GAD-7). This survey evaluates the frequency and intensity of anxiety symptoms, such as excessive worry and restlessness, to identify potential generalized anxiety disorders.

The assessment tool also takes a holistic approach to athlete health and safety, addressing both physical and psychological aspects of recovery, allowing athletes to provide self-reported objective evaluations of their experience with mental health. If contextualized towards concussion recovery and RTP, it holds the possibility to gain a deeper understanding of the comprehensive recovery. The primary researcher selected three of the validated questionnaires used in the SMHAT-1 to identify athlete anxiety, psychological strain and depression.

The Athlete Psychological Strain Questionnaire (APSQ).

The APSQ is a self-report 10-item, five-point Likert scale (0 = none of the time to 4 = all of the time) (Appendix F) that measures psychological distress in elite and high-performance athletes**.** Asking participants to rate statements such as "I was less motivated" and "I was irritable, angry, or aggressive". The APSQ displays a strong positive correlation to other measures of psychological distress, such as the Kessler Psychological Distress Scale (K-10) and the Depression Anxiety and Stress Scales (DASS-21) (Rice et al., 2020). The APSQ has high internal consistency across studies (Rice et al., 2020).

Generalized Anxiety Disorder Scale-7 (GAD-7).

The GAD-7 is a self-reported, seven-item questionnaire that is designed to measure anxiety-related symptoms on a 4-point Likert scale (0 = not at all to 3 = nearly every day) (Appendix G). Containing items such as "Feeling nervous, anxious or on edge" and "Not being able to control worrying". The GAD-7 construct validity is supported by high correlations to the Beck Anxiety Inventory and moderate correlations to the PHQ-9 (Spitzer et al., 2006). A reliability analysis revealed excellent internal consistency (Spitzer et al., 2006)

The Patient Health Questionnaire-9 (PHQ-9).

The PHQ-9 is a 9-item self-report four-point Likert scale (0 = not at all to 3 = nearly every day) (Appendix H) that measures participants' experience with symptoms of depression. Containing items such as "Little interest or pleasure in doing things" and "Feeling down, depressed, or hopeless". The PHQ-9 maintains high correlations with the Beck Depression Inventory-II (BECK-II) and the Hamilton Depression Rating Scale

(HAM-D) (Kroenke et al., 2001; Löwe et al., 2004). The PHQ-9 demonstrates strong internal consistency (Kroenke et al., 2001; Löwe et al., 2004)

Psychological Flexibility in Sport Questionnaire

The Psychological Flexibility in Sport Questionnaire (PFSQ) is a psychometric questionnaire designed to assess psychological flexibility within the context of sports. It is particularly relevant to sports injuries such as concussions because it assesses how athletes handle psychological challenges that arise during injury, recovery, and RTP. Psychological flexibility is a key factor in coping with the mental and emotional difficulties that often accompany sports injuries, such as frustration, anxiety, or fear of re-injury. For example, the PFSQ assesses an athlete's ability to accept these emotions without avoidance and remain focused on actions that support them. The questionnaire includes seven items that assess how thoughts, feelings, and external pressures impact an athlete's training and performance. The scale ranges from 1 (Very Untrue) to 7 (Always True), allowing participants to rate the extent to which each statement reflects their current experiences. The survey asked participants to rate statements such as, "Performance anxiety impairs my performance during competition," and "When I am competing my feelings impair my performance". Overall, the PFSQ has shown strong reliability and validity across different studies and cultural contexts, making it a valuable tool for assessing psychological flexibility in athletes (Doorley et al., 2020).

This survey was also contextualized to concussion. The survey maintained the same structure; a self-report seven-item, seven-point Likert scale (1 = Untrue to 7 = Always True) but aimed to evaluate psychological flexibility at the point of concussion and after RTP. For example, the researchers changed, "Performance anxiety impairs my

performance during competition," to "Anxiety about concussion impairs my performance during competition". See Appendix I for a complete contextualization of the survey.

Procedure

Participants who were interested in the study either used the QR code or contacted the Primary Researcher for more information and were sent a link to the online survey. The participants received a copy of the Letter of Information (Appendix J) when accessing the link. Consent was obtained via online participation (Consent Form – Appendix K). After consent was obtained, participants completed a battery of questionnaires in the following order: Athletic and Demographic History Questionnaire, SCAT-5, ACL-RSI - Contextualized to Concussion, APSQ, GAD-9, PHQ-7, and Psychological Flexibility in Sport Questionnaire Pre and Post– Contextualized to Concussion.

When the participants completed the Adapted Psychological Flexibility in Sport Questionnaire – Contextualized to Concussion, each item was presented twice. Once with instructions to reflect on how they felt at the time of their initial return to play and once based on how they currently feel at the time of the study.

After participants completed the questionnaires, they were given the opportunity to provide their email address if they wished to participate in a semi-structured interview. All participants were informed that they could withdraw their information up to two weeks following completion.

Statistical Analysis

Descriptive statistics were used to summarize participant demographics and survey results. Missing data was examined for each of the variables. Data were evaluated

for parametric assumptions. Correlations and linear regression models were used to evaluate objectives one through four. A paired samples t-test was employed to evaluate changes in psychological flexibility before RTP and after RTP.

1. What are the relationships between concussion symptoms and psychological adaptation as operationalized by depression, anxiety, and psychological strain following SRC?

To answer this question, bivariate correlations were examined between the variables. Linear regression analysis was used to examine the relationship between scores on the APSQ, GAD-7, and PHQ-9, and SCAT-5 symptom severity scores.

2. What are the relationships between confidence and psychological adaptations as operationalized by depression, anxiety, and psychological strain following SRC?

To answer this question, bivariate correlations were examined between the variables. Linear regression analysis was used to examine the relationship between scores on the APSQ, GAD-7, and PHQ-9, on the ACL-RSI.

3. What are the relationships between emotional and psychological responses (e.g., depression, anxiety, psychological strain), confidence, psychological flexibility and symptom experience (symptom total/severity), and time to return to play?

To answer this question, bivariate correlations between the variables were examined. Linear regression analysis was used to examine the relationship between recovery time on SCAT symptom severity/total, ACL-RSI, GAD-7, PHQ-9, and ACT scores.

4. What is the relationship between psychological flexibility, as operationalized by the components of acceptance and willingness in the ACT framework to confidence and psychological strain?

Bivariate correlations were conducted to examine the relationships between psychological flexibility (ACT Pre, ACT Post, and ACT Change scores) and confidence (ACL-RSI Total) and psychological strain (APSQ). Psychological flexibility is lso referred to as 'ACT'. In addition to the ACL-RSI Total score, individual ACL-RSI domains—Confidence, Emotions, and Risk Appraisal—were also analyzed to assess more nuanced associations between flexibility and confidence. Changes in psychological flexibility (pre- vs. post- ACT scores) at and after RTP were assessed using a paired samples t-test

As an exploratory, small sample study, statistical inference focused on effect size using Cohen's f^2 benchmarks for regression—small ($f^2 \approx 0.02$), medium ($f^2 \approx 0.15$), and large ($f^2 \approx 0.35$) (Cohen, 2013)—to interpret the proportion of variance explained (R^2) in the models. Correlational results were interpreted using Cohen's *r* benchmarks—small ($r \approx 0.10$), medium ($r \approx 0.30$), and large ($r \approx 0.50$) (Cohen, 2013).

Results

A total of 30 individuals who met the inclusion criteria participated in the study. Ages ranged from 16 to 42 years (M = 21.3, SD = 5.86). Some participants indicated participation in multiple sports when asked, “What is your sport?”. To distinguish what sport they were playing when they were concussed, we cross-referenced their mechanism of injury (MOI). Participants were involved in a variety of sports, including hockey (n = 10), lacrosse (n = 8), rugby (n = 5), football (n = 2), soccer (n = 2), basketball (n = 1), baseball (n=1), and track and field (n = 1). A majority of the participants were male (n = 23). When asked ‘What symptoms bothered you the most or most often?’ participants most frequently reported headaches (n = 18), sensitivity to light and noise (n = 14), dizziness (n = 7), brain fog (n = 6), and fatigue (n = 5). Symptoms were coded for analysis and were distinguished based on the different categories of concussion signs and symptoms: physical (e.g., headaches, dizziness, nausea, visual, pressure), cognitive (e.g., brain fog, sensitivity, fatigue), and emotional (e.g., irritability, emotional) symptoms. A complete demographic table for each participant can be found in Appendix L.

Table 1

Demographic Information

Variable	Median (Range)	N (%)
Age (years)	19.5 (16-42)	
Sex		
Male		23 (76.7%)
Female		7 (23.3%)
Sport		
Baseball		1 (3.3%)
Basketball		1 (3.3%)
Football		2 (6.7%)
Hockey		10 (33.3%)
Lacrosse		8 (26.7%)
Rugby		5 (16.7%)
Soccer		2 (6.7%)
Track and Field		1 (3.3%)
Physician Diagnoses		
Yes		22 (73.3%)
No		8 (26.7%)

Table 2 outlines missing data across various questionnaires for five participants. All five participants completed the Athletic and Injury Questionnaire. One participant was missing data from the ACL-RSI and SCAT-5, and two from the APSQ. All four were missing data from the GAD-7, PHQ-9, and Psychological Flexibility in Sport Scale.

Table 2

Participants with Missing Data

Questionnaire		Participant Number			
		14	16	21	22
Athletic and Injury Questionnaire					
ACL_RSI Adapted by Brown, O'Hagan, & Pownall					X
SCAT5 Symptom Severity Questionnaire					X
Modified Sports Mental Health Assessment Tool (SMHAT)	APSQ	X	X		X
	GAD-7	X	X	X	X
	PHQ-9	X	X	X	X
Psychological Flexibility in Sport Scale Contextualized by Brown, O'Hagan, & Pownall		X	X	X	X

Note. 'X' represents what data was not obtained from the following four participants. Questionnaires with an 'X' represent missing data.

Table 3 presents the descriptive statistics for key measures in the study. Total recovery time from concussion ranged from 3 to 76 days, (M = 27.8 SD = 17.0). On average, participants reported about two prior concussions (M = 1.9, SD = 1.7). Symptom severity, measured by the SCAT 5, had a mean number of symptom score of 15.6 (SD = 5.6) and mean symptom severity of 53.6 (SD = 27.5). Psychological measures indicated mild to moderate symptoms of anxiety and depression among participants. The mean GAD-7 score was 7.4 (SD = 4.4), which falls within the mild anxiety range (5–9), while the mean PHQ-9 score was 8.1 (SD = 4.6), indicating mild to moderate depression (PHQ-9 scores of 5–9 = mild; 10–14 = moderate) (Spitzer et al., 2006; Kroenke et al., 2001). The ACT scores showed from pre- to post-assessment, with means of 25.5 (SD = 9.3) and 23.6 (SD = 9.4).

Table 3

Descriptive Statistics for Main Measures

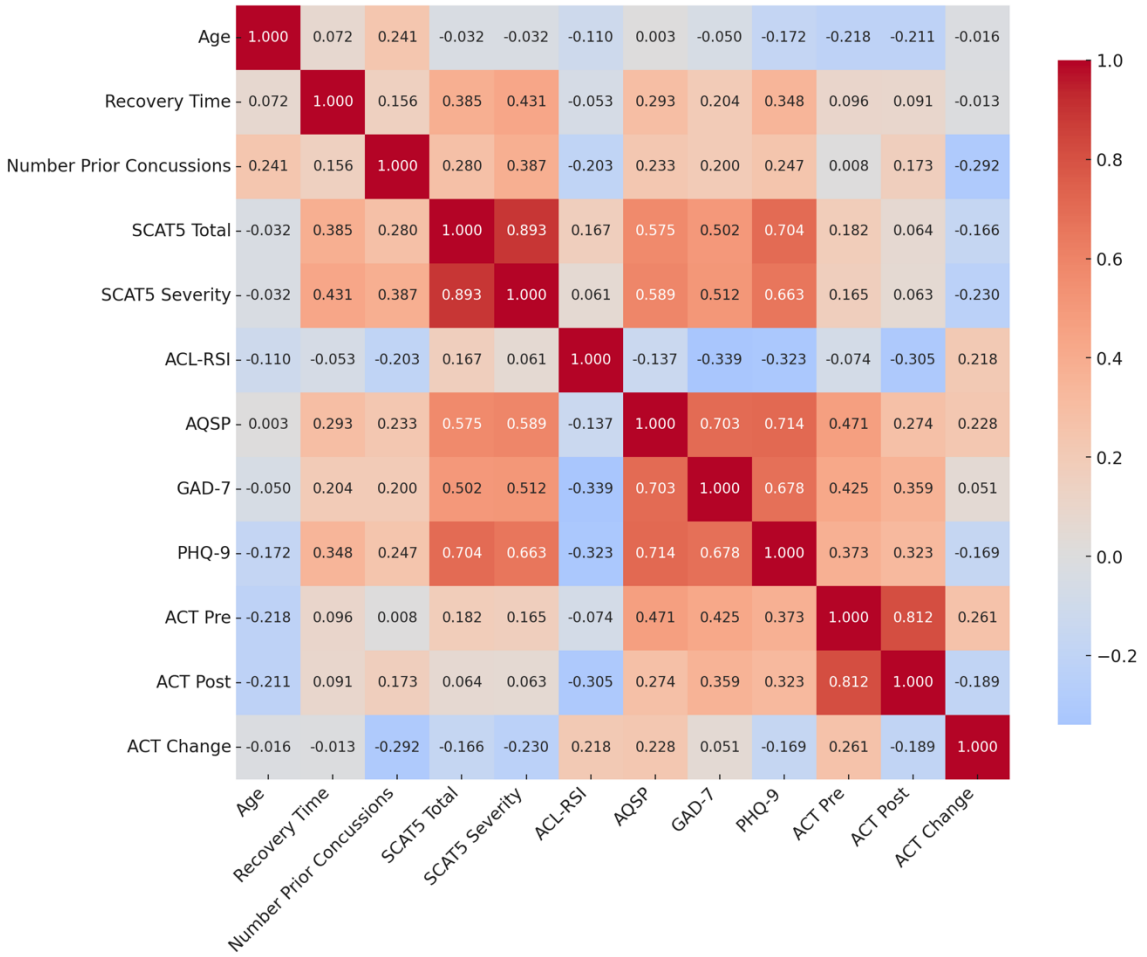
Variable	N	Mean	SD	Questionnaire Range
Age	30	21.3	5.86	–
Total Recovery Time (days)	30	27.8	17.0	–
Number of Prior Concussions	30	1.9	1.71	–
SCAT 5 Symptom Total	29	53.6	27.5	0 – 132
SCAT 5 Symptom Severity	29	15.6	5.6	0 – 22
ACL-RSI Total	29	64.9	11.4	0 – 100
APSQ Total	27	22.6	6.7	0 – 40
GAD-7 Total	26	7.4	4.4	0 – 21
PHQ-9 Total	26	8.1	4.6	0 – 27
ACT Pre	26	25.5	9.3	7 – 49
ACT Post	26	23.6	9.4	7 – 49
ACT Change	26	1.92	4.3	–

Note. This table presents descriptive statistics for key concussion-related measures, including age, recovery time, prior concussions, symptom severity, and psychological assessments. Values include the sample size (N), mean, standard deviation (SD), and questionnaire range scores. SCAT-5 Symptom Total and Severity reflect self-reported symptoms. ACL-RSI Total assesses psychological readiness to return to sport. APSQ, GAD-7, and PHQ-9 reflect psychological distress, anxiety, and depression, respectively. ACT Pre and Post reflect psychological flexibility scores before and after the recovery period. ACT Change reflects the numerical change between Pre and Post scores.

To explore potential relationships among psychological, demographic, and recovery-related variables, bivariate correlations were conducted. These analyses help identify how constructs such as symptom burden, psychological strain, anxiety, and depression relate to one another and to return-to-play outcomes. Figure 2 displays a correlation heat map illustrating the strength and direction of these relationships. For a full correlation matrix including confidence intervals, see Appendix M.

Table 4

Correlations Between Recovery, Symptom, Psychological Adaptation and ACT Measures



Note. Correlation coefficients (r) are interpreted using Cohen's (1988) guidelines: small (≈.10), moderate (≈.30), and large (≥.50). Correlations above r = .30 are considered worthy of attention.

Response to Research Questions

Are measures of psychological strain, anxiety, and depression associated with symptom severity scores on the SCAT-5?

The bivariate correlations (Table 4) revealed that all three psychological measures—psychological strain (APSQ: $r = .589$), anxiety (GAD-7: $r = .512$), and depression (PHQ-9: $r = .663$) had large, positive associations with SCAT-5 Symptom Severity scores. All correlations were statistically significant ($p < .01$), suggesting that athletes who reported higher levels of psychological strain, anxiety, and depression also reported significantly more severe concussion symptoms.

A linear regression was conducted to examine whether scores on measures of psychological strain, anxiety, and depression (APSQ, GAD-7, & PHQ-9) would predict symptom severity on the SCAT-5 Symptom Severity scale. All the predictors were submitted on the same level. The model explained approximately 51% of the variance in SCAT Symptom Severity ($R^2 = .515$). The overall model was statistically significant, $F(3,22) = 7.77$, p =.001, indicating that the set of predictors reliably explained variation in SCAT Symptom Severity scores.

Among the individual predictors, depression symptoms as measured by the PHQ-9 had the strongest unique contribution to symptom severity ($\beta = .615$, $p = .015$; Table 5). Neither psychological strain (APSQ: $\beta = .091$, $p = .686$) nor anxiety (GAD-7: $\beta = .048$, $p = .830$) explained significant proportions of SCAT symptom total. These findings suggest that depression is a key psychological factor related to elevated symptom reporting following concussion, while strain and anxiety may exert more overlapping or indirect effects. The independent relationships accounted for approximately 21% of the variance

explained, leaving the remaining 30% of the total variance as shared between the psychological predictors in explaining SCAT symptom severity.

Table 5

Predicting SCAT-5 Symptom Severity

Predictor	β	t	p	95% CI for B
APSQ	.091	0.409	.686	[-1.448, 2.164]
GAD-7	.048	0.217	.830	[-2.413, 2.976]
PHQ-9	.615	2.627	.015	[0.706, 6.327]

Note. Dependent variable = SCAT-5 Symptom Total. APSQ = Athlete Psychological Strain Questionnaire; GAD = Generalized Anxiety Disorder-7; PHQ = Patient Health Questionnaire-9. β = standardized coefficient.

Predictor	β	t	p	95% CI for B
APSQ	.091	0.409	.686	[-1.448, 2.164]
GAD-7	.048	0.217	.830	[-2.413, 2.976]
PHQ-9	.615	2.627	.015	[0.706, 6.327]

Note. Dependent variable = SCAT-5 Symptom Total. APSQ = Athlete Psychological Strain Questionnaire; GAD = Generalized Anxiety Disorder-7; PHQ = Patient Health Questionnaire-9. β = standardized coefficient.
 95% confidence intervals reflect the unstandardized B coefficients.

Are measures of psychological strain, anxiety, and depression associated with levels of readiness to return to sport?

The bivariate correlations (Table 4) revealed that none of the psychological measures—psychological strain (APSQ: $r = –0.137$), anxiety (GAD-7: $r = –0.339$), and depression (PHQ-9: $r = –0.323$) were significantly associated with psychological readiness (ACL-RSI Total). All correlations were non-significant ($p > .05$). Psychological strain exhibited a small negative association. Both anxiety and depression showed moderate negative associations, suggesting that higher levels of anxiety and depression may be moderately associated with lower psychological readiness.

A linear regression was conducted to examine whether psychological measures of psychological strain, anxiety, and depression (APSQ, GAD-7 and PHQ-9) would predict

scores of psychological readiness (ACL-RSI Total). All of the predictors were submitted on the same level. The model explained approximately 19% of the variance in ACL-RSI Total scores ($R^2 = .190$), with a moderate effect size ($f^2 \approx 0.24$). The overall regression model was not statistically significant, $F(3,22) = 1.72$, $p = .193$, suggesting that the set of predictors did not reliably explain variance in ACL-RSI Total scores.

These results suggest that depression, anxiety, and psychological strain, as measured by PHQ-9, GAD-7, and APSQ, are not significant predictors of psychological readiness to return to sport in this sample. However, the overall effect of these variables showed a moderate effect. Among the individual predictors (Table 6), depression symptoms as measured by the PHQ-9 demonstrated the strongest negative association with psychological readiness to return to sport ($\beta = –.380$, $p = .222$), though this relationship did not reach statistical significance. Anxiety symptoms (GAD-7: $\beta = –.219$, $p = .449$) and psychological strain (APSQ: $\beta = .188$, $p = .518$) also failed to significantly predict ACL-RSI Total scores. The independent relationships accounted for approximately 10% of the variance explained, leaving the majority of the explained variance (9%) shared between the combination of psychological strain, anxiety, and depression in predicting psychological readiness to return to sport (ACL-RSI scores).

Table 6

Predicting Psychological Readiness with Psychological/Mood Measures

Predictor	β	t	p	95% CI for B
APSQ	0.188	0.657	.518	[–0.693, 1.336]
GAD-7	–0.219	–0.770	.449	[–2.069, 0.948]
PHQ-9	–0.380	–1.258	.222	[–2.493, 0.610]

Note. Dependent variable = ACL-RSI = Psychological Readiness. APSQ = Athlete Psychological Strain Questionnaire; GAD = Generalized Anxiety Disorder-7; PHQ = Patient Health Questionnaire-9. β = standardized coefficient. 95% confidence intervals reflect the unstandardized B coefficients.

Is recovery time associated with scores on all other measures?

The bivariate correlations (Table 4) revealed that SCAT-5 Symptom Total (r = .431) and SCAT-5 Symptom Severity (r = .385) were most strongly associated with recovery time, both representing moderate effect sizes. Other psychological measures were not significantly associated with recovery time, but some showed small to moderate effects. Specifically, psychological strain (APSQ: r = .293) and depression (PHQ-9: r = .348) demonstrated moderate effects, while anxiety (GAD-7: r = .204) showed a small effect. The number of prior concussions (r = .156) was weakly associated with recovery time. Measures of psychological flexibility were weakly correlated with recovery time, with ACT Pre (r = .096) and ACT Post (r = .091) indicating negligible effects, and ACT Change (r = –.013) showing no meaningful relationship. This suggests that the severity of concussion symptoms is more closely tied to recovery duration than psychological or historical factors in this sample.

A linear regression analysis was conducted to examine whether recovery time could be predicted by a combination of SCAT-5 scores (symptom severity & symptom total), psychological strain (APSQ), anxiety (GAD-7), depression (PHQ-9), confidence (ACL-RSI), psychological flexibility (ACT Pre and Post), and number of prior concussions. All of the predictors were submitted on the same level. The overall model was not statistically significant, $F(9, 16) = 0.703$, $p = .698$, and explained approximately 28% of the variance in recovery time ($R^2 = .283$), reflecting a large effect size ($f^2 \approx 0.39$).

The SCAT-5 Symptom Severity showed the strongest positive relationship with recovery time ($\beta = .316$, $p = .587$), followed by ACT Post ($\beta = .282$, $p = .658$), SCAT-5 Symptom Total ($\beta = .260$, $p = .670$), and APSQ ($\beta = .268$, $p = .512$). ACT Pre

demonstrated a negative association (β = –.357, p = .589), as did GAD-7 (β = –.244, p = .471), PHQ-9 (β = –.062, p = .889), and ACL-RSI (β = –.045, p = .863). The number of prior concussions also contributed a small negative effect (β = –.110, p = .668). None of the individual predictors reached statistical significance (Table 7). The independent contributions of all predictors combined accounted for approximately 8% of the explained variance, with the remaining 20% shared among overlapping influences from psychological and symptom-related factors on recovery time.

Table 7

Predicting Recovery Time

Predictor	β	t	p	95% CI for B
SCAT-5 Symptom Total	0.225	0.435	.669	[–2.724, 4.141]
SCAT-5 Symptom Severity	0.320	0.562	.581	[–0.600, 1.037]
ACL-RSI	–0.035	–0.140	.891	[–0.881, 0.772]
APSQ	0.238	0.619	.544	[–1.542, 2.822]
GAD-7	–0.250	–0.776	.448	[–3.733, 1.725]
PHQ-9	–0.042	–0.100	.922	[–3.651, 3.321]
ACT_PRE	–0.277	–0.457	.654	[–2.999, 1.931]
ACT_POST	0.195	0.337	.740	[–1.950, 2.691]

Note. Dependent variable = Recovery Time. SCAT = Sport Concussion Assessment Tool; ACL-RSI = Anterior Cruciate Ligament Return to Sport Index; APSQ = Athlete Psychological Strain Questionnaire; GAD = Generalized Anxiety Disorder-7; PHQ = Patient Health Questionnaire-9; ACT = Acceptance and Commitment. β = standardized coefficient. 95% confidence intervals reflect the unstandardized B coefficients.

Are levels of psychological flexibility associated with confidence domains and psychological strain?

Psychological flexibility, as measured by the ACT questionnaire (where higher scores indicate lower flexibility), was explored in relation to psychological readiness and strain at return to play (RTP). Bivariate correlations (Table 4) were conducted to examine the associations between psychological flexibility (ACT Pre, ACT Post, and ACT

Change) and psychological readiness (ACL-RSI Total and subdomains: Confidence, Emotions, and Risk Appraisal), as well as psychological strain (APSQ).

ACT Pre-scores demonstrated a moderate negative correlation with ACL-RSI Confidence ($r = –.451$, $p = .021$), indicating that athletes who exhibited greater psychological flexibility at the time of RTP (i.e., lower ACT scores) reported higher confidence in returning to sport. Additionally, ACT Pre was moderately positively associated with APSQ scores ($r = .471$, $p = .015$), suggesting that athletes with lower psychological flexibility (higher ACT scores) experienced greater psychological strain.

ACT post-scores also showed a large, negative association with ACL-RSI Confidence ($r = –.577$, $p = .002$), suggesting that greater flexibility after RTP (i.e., lower ACT scores) was strongly associated with greater confidence in returning to sport. Other correlations with ACL-RSI Total ($r = –.305$), APSQ ($r = .274$), Risk ($r = –.127$), and Emotions ($r = .074$) demonstrated small to moderate effect sizes. However, these were not statistically significant.

ACT Change scores, which indicate shifts in flexibility, did not show significant associations with any outcomes. Nevertheless, small positive correlations were noted with ACL-RSI Total ($r = .218$), Emotions ($r = .307$), and APSQ ($r = .263$). Although these findings were not statistically significant, the correlations with Emotions and APSQ approached a moderate effect size. This suggests that Emotions, as a measure of psychological readiness, may relate to psychological flexibility and a deeper understanding of psychological strain in adapting to play, warranting further exploration. Emotional readiness may influence an athlete's ability to engage with or avoid difficult

internal experiences, suggesting a link between psychological flexibility and the way athletes adapt to stress and strain during return to play.

Bivariate correlations (Table 4) revealed small, negative associations between ACL-RSI and ACT Pre (r = –0.074) along with a moderate, negative association with ACT Post (r = –0.305). There was also a small positive association with ACT Change (r = 0.218). These findings suggest that while changes in psychological flexibility may relate to confidence to a small extent, measures of psychological flexibility are not significant predictors of psychological readiness to return to sport in this sample.

Psychological Flexibility (Pre and Post ACT Scores)

A paired samples t-test was conducted to compare scores of psychological flexibility on the ACT questionnaire, examining how athletes felt when they initially returned to play (pre) and how they felt at the time of questionnaire completion (post). There was a statistically significant difference in scores from pre (M = 25.5, SD = 9.3) to post (M = 23.6, SD = 9.4), t (25) = 2.28, p=.032, d=0.45. This result suggests that the intervening period between RTP and questionnaire completion (including game play) had a moderate effect, with a decrease in total ACT scores after RTP. The effect size, calculated using Cohen's d, was 0.45, indicating a moderate effect, indicating that psychological flexibility improved over the RTP period.

Discussion

The objective of the current study was to examine how concussed athletes process their recovery using the framework provided by ACT to examine psychological flexibility, mood, and overall adjustment to sport after injury. Key findings showed that depression significantly predicted concussion symptom severity, while psychological flexibility increased over the RTP process. Greater flexibility was moderately to strongly linked with higher sport confidence and lower psychological strain, highlighting its potential role in supporting mental well-being and recovery readiness. This research contributes to the growing body of literature that recognizes psychological recovery as a critical, yet often underrepresented, dimension of SRC recovery. By framing recovery through the lens of psychological flexibility, this study offers a novel approach to understanding how athletes navigate the emotional and cognitive challenges of post-concussion rehabilitation. Specifically, it emphasizes the value of exploring how acceptance, willingness, and emotional regulation may influence readiness to return to play and how athletes adjust to the stressors associated with SRC.

Depression, Symptom Severity, and Avoidance

One important finding of this study was empirical confirmation of the relationship between mental health factors and concussion symptoms. Large effect sizes were detected between concussion symptom severity, anxiety, psychological strain, and depression. This finding indicates that mood, specifically depression, plays a role in symptom experience. A linear regression analysis revealed that depression scores significantly predicted symptom severity scores, accounting for a substantial amount of the variance. Overall, this suggests that people who report higher levels of depression

tend to report more severe concussion symptoms. Prior research investigating mood disturbances in people with concussion has reported that depression has the potential to exacerbate physical symptoms following a concussion (Kontos et al., 2012). These results indicate that concussion recovery may be influenced by an athlete's psychological state in addition to physiological processes.

Why is depression a concern in SRC? One key issue is that we often lack a clear understanding of how depressive symptoms emerge and influence behaviour following injury. Removal from play can have a profound psychological impact, particularly for athletes whose identities are strongly tied to their sport (Todd et al., 2018).. Removal from play alone may be enough to spike the experience of depression, also known as situational depression. A short-term, stress-related depressive response to a significant life event or loss. In this case, the removal from sport and disruption of daily structure, goals, and social networks may be sufficient to initiate depressive symptoms that intensify the athlete's perception of post-concussion difficulties.

Depression is also a symptom on the SCAT-5 Symptom Questionnaire, making it difficult to determine whether reported depressive symptoms reflect a psychological reaction to being sidelined or a neurobiological consequence of the brain injury itself. For example, removal from play may challenge an athlete's sense of identity and trigger a depressive response that heightens sensitivity to other symptoms. In contrast, it is also plausible that the brain injury causes depressive symptoms directly, which then impair emotional regulation, motivation, or coping, ultimately worsening recovery outcomes.

Depression, in this light, is not just a symptom to manage but a potential indicator of misalignment between an athlete's values and current reality (e.g., competing vs.

sitting on the sidelines). From an ACT perspective, psychological inflexibility, such as entanglement with distressing thoughts, emotional avoidance, or withdrawal from activities aligned with one's core values may amplify symptom experience and hinder recovery. This means that avoiding discomfort and getting stuck in negative thoughts may exacerbate symptoms, whereas ACT encourages acceptance and value-driven action to help alleviate the burden of discomfort and negative thoughts. If athletes lack the tools to accept this shift or connect with their values beyond performance, psychological distress may worsen, further complicating recovery. When athletes do not accept the change in their physical state or identity, they may experience more psychological distress, such as depression.

Anxiety, Psychological Strain, and Depression

Strong effect sizes were also detected between psychological strain, anxiety, and depression, all of which showed large, statistically significant intercorrelations. In both clinical and sports settings, it has been reported that psychological domains rarely operate in isolation (Gioia et al., 2009). Rather, they can co-occur and can interact to compound recovery difficulties. From an ACT perspective, these overlapping emotional responses may stem from psychological inflexibility**.** When athletes become entangled with distressing thoughts that may occur during concussion recovery and engage in avoidance of the emotional discomfort, or disconnect from core values during recovery, this behaviour demonstrates rigidity. Athletes displaying rigid behaviours, such as avoidance of vulnerability, may reduce help-seeking behaviours. In addition, sustained negative thoughts may also sustain depressive symptoms, and a lack of present-moment awareness may increase perceived threat and anxiety. These findings suggest that psychological and

mood states are interconnected. While depression plays a major role in symptom severity, targeting anxiety and psychological strain through interventions aiming to increase psychological flexibility, through mindfulness, values clarification, and cognitive defusion, could offer broad benefits, through a general internal experience. Conversely, fostering greater psychological flexibility may not only aid distress but also promote more adaptive responses to symptoms, supporting a healthier RTP experiences.

Psychological Readiness and Emotional Distress

Moderate negative associations were observed between psychological readiness and anxiety and depression. Athletes experiencing greater anxiety and depression appeared to feel less ready to return to sport. These findings align with research showing that unresolved psychological symptoms such as excessive worry, intrusive thoughts, and low mood are associated with reduced return-to-play confidence (Ardern et al., 2013; Webster et al., 2018). From an ACT perspective, athletes struggling with anxiety or depressive symptoms may be tied to threat-based thinking that diminishes self-efficacy and psychological readiness. Psychological flexibility interventions targeting these patterns may help athletes navigate distress and support a more confident, value-driven return to play.

By promoting psychological flexibility, ACT may help athletes disconnect from distressing internal thoughts and reconnect with values such as perseverance, growth, or team connection—even when anxiety or pain is present. This process may not only support safer return-to-play decisions but also protect long-term well-being and reduce the risk of reinjury, particularly in athletes with elevated emotional distress or rigid athletic identity (Brewer & Petitpas, 2017).

Why Measures of Psychological Adaptations Did Not Predict Confidence

The findings suggest that measures of anxiety, depression, and psychological strain did not have a relationship to confidence during concussion recovery. It is possible that the psychological measures used, depression (PHQ-9), anxiety (GAD-7), and psychological strain (APSQ), may not fully capture the psychological factors that influence confidence and readiness to return to sport after injury. The constructs measured by these scales may not be as closely related to confidence as other psychological traits, such as resilience, which has been found to be stronger predictors of athletic identity (Podlog & Eklund, 2007). Additionally, athletes may still feel confident despite experiencing a lower mood.

Additionally, the design of the Adapted ACL-RSI scale may have also played a role. The nature of the ACL-RSI scale, which primarily focuses on physical and psychological readiness to return to sport, may not fully align with SRC recovery. Adding to this possible discrepancy, the lack of evidence-based reliability and validity of the Adapted ACL-RSI, contextualized to concussion RTP, may have affected the results. Confidence may depend less on the presence or absence of psychological distress and more on the individual's willingness to experience that distress in pursuit of meaningful action, such as RTP.

Psychological Flexibility: A Process for Adaptive Recovery

Recovery Time: Duration vs. Subjective Experience

When examining the impact of recovery time on other measures, a moderate correlation was observed between SCAT-5 Symptom Severity and total recovery time, as well as SCAT-5 Symptom Total, indicating that athletes who reported more severe

symptoms tended to experience longer recovery durations. This has been supported in past research, wherein severe symptoms have been associated with a prolonged recovery (McCrea et al., 2013).

Athletes who have experienced multiple concussions may be at risk of more severe symptoms and increased recovery with each subsequent concussion. Moreover, cumulative head trauma, for example, two concussions within a small window, may increase brain sensitivity, making it more difficult to recover in a short period or at all, also known as PCS. This means that we may need to better monitor the severity of symptoms to help reduce the overall burden.

This suggests that while psychological flexibility influences how athletes cope with recovery, it may not significantly impact the duration of recovery. Psychological flexibility may indirectly contribute to safer RTP by shaping how athletes interpret and respond to symptoms. An athlete who accepts fatigue or headaches as a part of the recovery process may be less likely to hide symptoms or rush the RTP process, reflecting their commitment to long-term values despite temporary discomfort. By improving psychological flexibility, we might indirectly reduce risk-taking behaviours (e.g., under-reporting symptoms or rushing the RTP process) by helping athletes attend to symptoms more honestly and navigate the RTP process with greater clarity of their values and practicing self-compassion.

Flexibility in Action: Shifts Across the RTP Process

A key objective of this study was to assess changes in psychological flexibility after the RTP process. Psychological flexibility significantly improved from pre- to post-RTP, as indicated by a decrease in ACT. This decrease in ACT scores can be interpreted

as an increase in psychological flexibility. The ACT scale assesses the extent to which individuals can accept their thoughts and emotions without them interfering with valued actions. ACT does not aim to eliminate symptoms but instead supports individuals in changing their relationship with discomfort. Emphasizing acceptance and committed action in alignment with personal values (Hayes et al., 1996). Through this process, symptom distress may decrease as a byproduct. Athletes in this study demonstrated significantly improved psychological flexibility from pre- to post-RTP, suggesting that sport re-engagement itself may foster more adaptive ways of relating to internal experiences. These findings align with past work showing that ACT interventions are effective in improving psychological outcomes and reducing experiential avoidance in athletes recovering from injury (Frögéli et al., 2016; Mosewich et al., 2019). This could reflect that exposure to sport and competition improves acceptance, or a greater willingness to allow distress (e.g., anxiety about re-injury) without letting it influence behaviours. From an ACT lens, this demonstrates how committed action (e.g., returning to play despite fear) can foster a growth mindset, especially when grounded in personally meaningful values of the athlete. It is important to acknowledge that fear can also serve a protective function; when it arises prior to medical approval**,** it may reflect an adaptive response to risk, rather than mere avoidance.

ACT and Emotional Distress

The moderate positive correlations between ACT Pre scores and anxiety, psychological strain, and depression suggest that greater psychological inflexibility is associated with heightened emotional distress. Within the ACT model, inflexibility reflects an athlete's difficulty in remaining open to unpleasant internal experiences (e.g.,

anxious thoughts, stress, sad emotions), often leading to avoidance and cognitive fusion. For example, an athlete fused with the thought “I’ll never get back to normal” may begin to withdraw from training, teammates, or valued roles. While this behaviour is intended to reduce the discomfort of not playing, avoidance may actually paradoxically prolong suffering and undermine engagement in meaningful activities.

Athletes reporting lower psychological flexibility experienced greater levels of strain, aligning with existing ACT research suggesting that inflexibility is linked to increased distress and poor coping in sport and health contexts (Hayes et al., 1996). Athletes who were more psychologically inflexible reported greater levels of strain, which supports ACT’s premise that willingness and openness to difficult experiences can reduce the psychological burden of injury and sport pressures. Psychological inflexibility, described by avoidance, entanglement with distressing thoughts, and resistance to discomfort, can intensify strain during a challenging recovery period.

Further, avoidance of post-concussion emotions like fear, frustration, or loss may narrow attentional focus and inhibit the natural psychological adaptation processes (Hayes et al., 1996) needed for recovery, resulting in further engagement of cognitive fusion, the opposite of cognitive defusion. Athletes who struggle to make space for these emotions may become stuck in maladaptive coping patterns, such as denial, overexertion, or isolation. From this lens, anxiety, strain, and depressive symptoms are not just comorbidities but further signals of inflexible patterns that restrict psychological healing. ACT-based interventions targeting these patterns have demonstrated efficacy in reducing anxiety and depression across various populations. They may be particularly valuable in

helping athletes develop openness and flexibility in response to injury-related stressors (Beygi et al., 2023; Gross et al., 2018).

These associations were weaker at ACT Post anxiety, psychological strain, and depression**,** suggesting that psychological flexibility improved after the return to sport**.** This may reflect a restoration of athlete identity, reconnection with valued activities, and increased contact with the present moment. As athletes re-engage with their sport and resume familiar routines, they may naturally experience less fusion with injury-related thoughts, in addition to the overall decrease in symptom burden. This transition may partially explain the increase in psychological flexibility observed post-RTP, a finding that supports the view that contextual and value-driven behaviour (i.e., being back in sport) facilitates recovery (Gardner & Moore, 2007; Gross et al., 2018).

ACT and Confidence: Adaptive Acceptance

Psychological flexibility at the time of RTP (ACT Pre) was moderately and negatively associated with ACL-RSI Confidence. This inverse relationship indicates that higher psychological flexibility (lower ACT scores) was associated with greater confidence to resume sport. This result aligns with core principles of ACT that emphasize adaptive acceptance and value-driven committed actions (Hayes et al., 1996). Moreover, ACT Post was even more strongly correlated with ACL-RSI Confidence, reflecting a large effect size. This suggests that athletes who maintain or develop psychological flexibility after a complete RTP may feel more confident, both emotionally and cognitively, during the re-engagement in sport. Confidence is a key predictor of successful RTP, and the strength of these associations suggests that interventions

targeting flexibility may play a substantial role in fostering readiness and reducing hesitation or fear of reinjury (Webster et al., 2018).

Keeping Athletes Safe Through ACT

From a safety perspective, these findings support the use of ACT-informed psychological interventions to mitigate risk during RTP. Psychological flexibility enhances the ability to engage with difficult thoughts and emotions without avoidance (Hayes et al., 1996). ACT can prevent maladaptive patterns such as rumination, fear of RTP, or premature return driven by athletic identity. Athletes who strongly identify with their sport may feel pressured to suppress psychological concerns in order to maintain their role (Cosh et al., 2013), increasing the risk of reinjury and longer-term consequences. These findings, particularly the large effect sizes linking psychological flexibility to the confidence domain of the ACL-RSI Adapted, highlight the potential of ACT-based strategies, such as cognitive defusion and values clarification, to address athlete identity entanglement and promote both psychological and physical safety during RTP.

These results extend prior work on psychological readiness by offering empirical support for the relevance of psychological flexibility in RTP outcomes. While previous models of RTP have emphasized physical benchmarks, this study highlights how psychological variables, specifically psychological flexibility, are strongly linked to confidence and strain, both of which are critical for ensuring a safe and supported transition back to sport**.** As concussion management evolves to incorporate more holistic approaches, ACT provides a flexible, evidence-based framework for enhancing athlete

resilience, regulating emotional responses, and supporting autonomy and safety in RTP decisions.

Limitations, Strengths, and Future Research

While this study provides valuable insight into concussion RTP and recovery, several limitations must be acknowledged. The sample size (N=30) was relatively small, which limits the generalizability of the findings. Additionally, missing data from several participants reduced the statistical power of some analyses. However, the sample represents a relatively difficult-to-access population (i.e., athletes recovering from sport-related concussion), which highlights the practical value of the data collected. Future research should include a larger and more diverse sample and aim to continue embedding psychological flexibility into concussion-based research to aid in better understanding the core principles of ACT that drive human behaviours.

While none of the participants opted to complete the interview in this study, this presents a valuable opportunity for future research to deepen the understanding of how athletes process their recovery through qualitative inquiry, enriching the mixed methods approach with firsthand narratives of concussion recovery. Interviews are valuable for capturing the nuanced personal experiences, perceptions, and psychological impacts that are not fully captured in survey-based data. In this study, the interviews were created and guided by the ACT framework, which would have been useful for further understanding how athletes perceive and respond to concussions while understanding their cognitive representations, values, barriers, and behaviours. The lack of interviewees suggests a potential barrier to engaging athletes in concussion-related discussions.

There may be several reasons for this hesitancy. Athletes may avoid discussing their concussion experiences due to stigma, as acknowledging symptoms could be perceived as a sign of weakness or a threat to their status on the team. Additionally, some athletes may worry about sharing details regarding their recovery process due to athletic eligibility, selection pressures, or relationships with teammates and coaches. Others may simply wish to move on from the injury and avoid revisiting potentially distressing details or a frustrating period. Although recruitment remained open for over six months, the absence of the interviewees highlights challenges in concussion research.

While these limitations posed some issues, it is also important to note the strengths of this research. Firstly, it is also one of the first research studies to incorporate psychological flexibility in attempting to understand concussion recovery. In addition, this is one of the first research studies to contextualize the validated ACL-RSI questionnaire to confidence and concussion RTP.

Future research should continue to investigate the role of psychological recovery in RTP from concussion. With further research and potential measures of psychological recovery that can be implemented in conjunction with the RTP Protocol, we can prioritize athlete well-being. Measures such as confidence in RTP in a larger sample, possibly working towards validating a concussion and confidence survey might be a useful measure for gauging if the athlete is mentally ready for RTP. In addition, research should continue using a psychological flexibility lens to better understand athletes' perceptions during their recovery with a focus on qualitative measures.

Conclusion

The findings of this study emphasize the significant role that an athlete's psychological response plays in their concussion recovery and return-to-play process. While established protocols address the physiological aspects of recovery, a gap remains in addressing the psychological factors that influence an athlete's rehabilitation. This research explored recovery through the framework of Acceptance and Commitment Therapy, highlighting the importance of psychological flexibility.

Using the ACT framework, this research demonstrated that athletes who exhibited greater psychological inflexibility reported more severe symptoms, higher levels of anxiety, depression, and psychological strain, and longer recovery durations. Psychological flexibility was positively associated with confidence in returning to play, and flexibility significantly improved over time. Although the lack of qualitative data limits insight into how these psychological processes unfold, the results support incorporating ACT-informed strategies into concussion management.

Moving forward, concussion management should incorporate psychological recovery measures alongside physical assessments. Understanding return-to-play through the lens of psychological flexibility may provide valuable insights into improving concussion protocols and supporting athlete well-being throughout their recovery.

Imagine being an 18-year-old soccer player experiencing this firsthand. You sustain a concussion during the most important game of your season. As the days turn into weeks, you feel isolated—your team moves on without you, and your symptoms are influencing your recovery time. Finally, after being cleared to return, the game feels different, and fear holds you back. Every fall and collision make you second-guess

yourself. This experience mirrors the study's findings: psychological strain, anxiety, and depression often accompany the physical symptoms of concussion. Yet, over time, with gradual exposure and adaptation, psychological flexibility improves. The once scared and hesitant athlete at the time of clearance to play now pushes forward.

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Appendix A

Return to Sport Protocol

Stage	Description	Activity Guidelines	Progression Criteria
Stage One: Symptom-Limiting Activities	24–48 hours of rest with limited cognitive and physical activity.	Light activities such as moving around the house, simple chores, and gradual return to school/home activities as tolerated.	Progress if no new or worsening symptoms over a 24-hour period.
Stage Two: Light Aerobic Activity	Light exercise gradually increases intensity.	Activities like walking or riding a stationary bike for 10–15 minutes. No sport-specific or strength training.	
Stage Three: Individual Sport-Specific Exercise with No Contact	Introduce sport-specific activities without physical contact.	Examples: skating/shooting for hockey, running/throwing for football. Activity limited to 20–30 minutes. No contact or strength training.	
Stage Four: Begin Training Drills with No Contact	Increase difficulty of sport-specific drills by adding cognitive elements.	Engage in non-contact drills and begin strength training.	
Stage Five: Full Contact Practice Following Doctor Clearance	Return to full-contact practice after medical clearance.	Participate fully in team practice with contact and at full capacity.	
Stage Six: Return to Sport	Full return to competition and gameplay.	Athletes may resume normal play without restrictions.	Final stage achieved after successfully completing all prior stages.

Note. The Return to Sport Protocol outlined in this figure emphasizes a gradual and structured progression to ensure safety and minimize the risk of re-injury (Parachute Canada., 2018). Each stage builds on the previous one, requiring athletes to meet specific progression criteria before advancing. Adherence to these guidelines is critical for recovery, particularly following injuries like concussions, where premature return to activity can have severe consequences.

Appendix B

Social Media Graphic

Appendix C

Demographic & Athletic Injury Questionnaire

How old are you?

What is your sport?

Highest level of competition?

What was the date and time of your injury?

How were you injured?

Was your injury diagnosed by a physician?

While you were recovering, what symptoms bothered you the most or most-often?

How long was your return to play process? In other words, how much time passed before you were able to resume your regular activities (school, sports, hobbies)? Ideally, provide us with a specific date.

Had you injured this body part before this most-recent injury? If so, how many times?

Are you currently taking any medications related to your injury?

Appendix D

Sport Concussion Assessment Tool – 5 (SCAT-5)

Rate your symptoms during your return to play process to the best of your recollection, where 0 is none and 6 is severe.

	0 (none)	1	2	3	4	5	6 (severe)
Headache							
"Pressure in head"							
Neck Pain							
Nausea or vomiting							
Dizziness							
Blurred vision							
Balance problems							
Sensitivity to light							
Sensitivity to noise							
Feeling slowed down							
Feeling like "in a fog"							
"Don't feel right"							
Difficulty concentrating							
Difficulty remembering							
Fatigue or low energy							
Confusion							
Drowsiness							
More emotional							

Irritability
Sadness
Nervous or Anxious
Trouble falling asleep

Did your symptoms get worse with physical activity?

- ○ Yes (1)
- ○ No (2)

Did your symptoms get worse with mental activity?

- ○ Yes (1)
- ○ No (2)

If 100% is feeling perfectly normal, what percent of normal do you currently feel?

_____

Appendix E

ACL-RSI Adapted by Pownall, Brown, & O'Hagan

Name_____Date_____

Instructions: Place a mark on the line, which best describes you in relation to the descriptors.

Are you confident that you can perform at your previous level of sport participation?

Not at all confident Fully confident

□ □ □ □ □ □ □ □ □ □ □

0 10 20 30 40 50 60 70 80 90 100

Do you think you are likely to experience another concussion by participating in your sport?

Not at all confident Fully confident

□ □ □ □ □ □ □ □ □ □ □

0 10 20 30 40 50 60 70 80 90 100

Are you nervous about playing your sport?

Not at all confident Fully confident

□ □ □ □ □ □ □ □ □ □ □

0 10 20 30 40 50 60 70 80 90 100

Are you confident that you can play without experiencing symptoms?

Not at all confident Fully confident

□ □ □ □ □ □ □ □ □ □ □

0 10 20 30 40 50 60 70 80 90 100

Are you confident that you could play your sport without concern for your head?

Not at all confident Fully confident

□ □ □ □ □ □ □ □ □ □ □

0 10 20 30 40 50 60 70 80 90 100

Do you find it frustrating to have to consider your head with respect to your sport?

Not at all confident Fully confident

□ □ □ □ □ □ □ □ □ □ □

0 10 20 30 40 50 60 70 80 90 100

Are you fearful of re-injuring your head by playing your sport?

Not at all confident Fully confident

□ □ □ □ □ □ □ □ □ □ □

0 10 20 30 40 50 60 70 80 90 100

Are you confident about your mental capacity holding up under pressure?

Not at all confident Fully confident

□	□	□	□	□	□	□	□	□	□	□
0	10	20	30	40	50	60	70	80	90	100

Are you afraid of accidentally injuring your head by playing your sport?

Not at all confident Fully confident

□	□	□	□	□	□	□	□	□	□	□
0	10	20	30	40	50	60	70	80	90	100

Do thoughts of having to go through a prolonged concussion recovery playing your sport?

Not at all confident Fully confident

□	□	□	□	□	□	□	□	□	□	□
0	10	20	30	40	50	60	70	80	90	100

Are you confident about your ability to perform well at your sport?

Not at all confident Fully confident

□	□	□	□	□	□	□	□	□	□	□
0	10	20	30	40	50	60	70	80	90	100

Do you feel relaxed about playing your sport?

Not at all confident Fully confident

□	□	□	□	□	□	□	□	□	□	□
0	10	20	30	40	50	60	70	80	90	100

Appendix F

Athlete Psychological Strain Questionnaire (APSQ)

These questions concern how you felt during your return to play process. Please indicate the answer that best presents how you felt during that time.

	None of the time	A little of the time	Some of the time	Most of the time	All of the time
It was difficult to be around teammates	○	○	○	○	○
I found it difficult to do what I needed to do	○	○	○	○	○
I was less motivated	○	○	○	○	○
I was irritable, angry or aggressive	○	○	○	○	○
I could not stop worrying about injury or my performance	○	○	○	○	○
I found training more stressful	○	○	○	○	○
I found it hard to cope with selection pressures	○	○	○	○	○
I worried about life after sport	○	○	○	○	○
I needed alcohol or other substances to relax	○	○	○	○	○
I took unusual risks off-field	○	○	○	○	○

Appendix G

General Anxiety Disorder – 7 (GAD-7)

The following questions relate to feeling anxious or stressed. Over your return to play process, how often were you by the following problems? Please indicate the answer that best represents how you felt.

	Not at all	Several days	More than half the days	Nearly every day
Feeling nervous, anxious, or on edge	○	○	○	○
Not being able to stop or control worrying	○	○	○	○
Worrying too much about different things	○	○	○	○
Trouble relaxing	○	○	○	○
Being so restless that it's hard to sit still	○	○	○	○
Becoming easily annoyed or irritable	○	○	○	○
Feeling afraid as if something awful might happen	○	○	○	○

Appendix H

Patient Health Questionnaire – 9 (PHQ-9)

The following questions relate to feelings of depression, sadness, or being blue. During your return-to-play process, how often were you bothered by any of the following problems? Please indicate the answer that best represents how you felt.

	Not at all	Several days	More than half the days	Nearly every day
Little interest or pleasure in doing things	○	○	○	○
Feeling down, depressed or hopeless	○	○	○	○
Trouble falling asleep, staying asleep, or sleeping too much	○	○	○	○
Feeling tired or having little energy	○	○	○	○
Poor appetite or overeating	○	○	○	○
Feeling bad about yourself - or that you're a failure or have let yourself or your family down	○	○	○	○
Trouble concentrating on things, such as reading the newspaper or watching televison	○	○	○	○
Moving or speaking so slowly that other people could have noticed. Or, the opposite - being so fidgety or restless that you have been moving a lot more than usual	○	○	○	○
Thoughts that you would be better off dead or hurting yourself in some way	○	○	○	○

Appendix I

Adapted Psychological Flexibility in Sport Questionnaire - Contextualized to Concussion

The following question set will ask you to reflect on how you felt at the time of Return-to-Play and now in the present moment.

1.

Rate the following statement based on when you initially returned to competition.

The memories and experiences from my concussion have a negative impact on me while I am training and performing.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

Rate the following statement based on how you currently feel.

The memories and experiences from my concussion have a negative impact on me while I am training and performing.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

2.

Rate the following statement based on when you initially returned to competition.

When training/performing, I cannot control thoughts about concussion that negatively affect my performance.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

Rate the following statement based on how you currently feel.

When training/performing, I cannot control thoughts about concussion that negatively affect my performance.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

3.

Rate the following statement based on when you initially returned to competition.

When I am competing my thoughts of concussion impair my performance.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

Rate the following statement based on how you currently feel.

When I am competing my thoughts of concussion impair my performance.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

4.

Rate the following statement based on when you initially returned to competition.

When I am competing my feelings of concussion impair my performance.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

Rate the following statement based on how you currently feel.

When I am competing my feelings of concussion impair my performance.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

5.

Rate the following statement based on when you initially returned to competition.

The pressure I feel from others to compete negatively affects my training and performance.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

Rate the following statement based on how you currently feel.

The pressure I feel from others to compete negatively affects my training and performance.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

6.

Rate the following statement based on when you initially returned to competition.

Anxiety about concussion impairs my performance during competition.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

Rate the following statement based on how you currently feel.

Anxiety about concussion impairs my performance during competition.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

7.

Rate the following statement based on when you initially returned to competition.

Worry about re-injury makes my performance worse when I am training and competing.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

Rate the following statement based on how you currently feel.

Worry about re-injury makes my performance worse when I am training and competing.

Very Untrue	Very Seldom True	Seldom True	Sometimes True	Frequently True	Almost Always True	Always True
1	2	3	4	5	6	7

Appendix J

Letter of Information

DEPARTMENT OF PSYCHOLOGY
Action & Cognition @ Trent (ACT) Lab
actlab.trent@gmail.com

Emma Pownall, B.Sc. Kin
Psychology Graduate Student
Telephone: (705)-772-2519
Email: emmapownall@trentu.ca

Liana E. Brown, Ph.D.
Associate Professor
Telephone: (705)-748-1011 x7238
Fax: (705)-748-1580
Email: lianabrown@trentu.ca

Letter of Information - Questionnaire

Project Title: Emotional Appraisal and Acceptance and Commitment in Concussed Athletes: A Mixed Methods Study
Graduate Student Investigator: Emma Pownall, B.Sc. Kin
Faculty Investigators: Liana E. Brown, Ph.D.

0. Purpose:
The purpose of the current study is to learn more about an athlete's perception of their mental health as they recover from a concussion and return to play.

1. Participation inclusion/exclusion criteria:
To participate in the study:
- All individuals are required to be competing in a sport.
- All individuals must be between the ages of 16 to 60.
- All participants need to have sustained a concussion that removed them from play.
- All participants must have completed the return to play process within the last three months.
- All participants should be otherwise considered healthy.

We cannot allow you to participate if you:
- Have been diagnosed with a short or long-term condition that could affect their participation in daily life.
- Have been diagnosed with neurological dysfunction that was not caused by the concussion.

2. Procedures to be followed:
We would like you to complete several questionnaires. The questionnaires will focus on your experience of concussion symptoms, your mental health, and your feelings about returning to play.

The questionnaires will be completed on a computer.

In one of our questionnaires you will be asked how often you have had, "Thoughts that you would be better off dead or hurting yourself in some way". If you indicate that you have felt this way "more than half the days" or "nearly everyday" we have a duty to report this as an indication of self-harm. In this case, we would call Trent University Security and follow their direction. This is the same instruction provided to all members of the University community to follow if they are presented with a person indicating a willingness to self-harm. We have added resources below for you to contact if you find any of the testing distressing. If at any point, now or in the future, you experience a willingness to self-harm, we strongly encourage you to reveal these thoughts to family or friends, one of the organizations we have listed below, police, ambulance, fire, or to go to the emergency department at the hospital. Help is available.

3. Time duration of the procedures and study:
Your participation in this research will involve 2 hours in total.

4. Benefits to you:

By participating in this research, you will get a chance to tell us about and reflect on your concussion.

5. Benefits to society:
Concussions are complex injuries that are frequently misunderstood. This research will help us better understand how an athlete's feelings, coping strategies, and support systems contribute to their recovery and return to play.

6. How the data will be used:
The researchers declare that they have no potential conflicts of interest: we will not experience any specific personal or financial gain or loss from the results of this experiment. The researcher has no plan currently to develop a for-profit venture from the findings of this research.

7. Voluntary participation:
Your participation is entirely voluntary. You are free to stop participating in the research at any time or to decline to answer any specific questions without loss of promised compensation. To withdraw from the experiment, you simply need to inform the investigator of your wish to withdraw by email or by telephone.

Should you choose to withdraw your data from the study, you will have two weeks following competition to contact the primary researcher to withdraw free of penalty.

8. Statement of confidentiality:
Your participation in this research is entirely confidential. Only the primary investigator (Emma Pownall) will have access to identifying information. To make sure that participation is confidential, individuals' data will be distinguished by a code number and only the person(s) in charge will have access to the materials that link names to the code. If this research is published, no personally identifying information will be disclosed. Five years after the data are published all identifying paperwork will be shredded and deleted.

It is becoming more and more common for researchers to share their data sets with other researchers. We will share only a de-identified version of our data and it will be made available only to other researchers or research trainees.

9. Discomforts and risks:
Please be assured that the questionnaires are designed to document your experience. This experience may be uncomfortable or stressful to recall. Some individuals may find the questions frustrating or hard to talk about. Remember that you are free to refuse to answer any question or to withdraw at any time. Should you want or need additional concussion and mental health resources please refer to the links below.
PACA: https://www.paca.health/resources/
Education: https://cattonline.com/
Policy: https://www.ontario.ca/page/rowans-law-concussion-safety
Mental Health: https://cmhahkpr.ca/
Recovery & Support: https://www.headsupcan.ca/sharing-experiences-with- concussion/tbi

10. Post-experiment feedback and right to ask questions:
You will be given an opportunity to ask any questions that you may have, and all such questions or inquiries will be answered to your satisfaction. We will answer any questions you have at any time, before, during, or after the study is completed. If you have questions in the future, you are welcome to contact Emma Pownall at emmapownall@trentu.ca or Liana Brown at 705-748-1011 x7238 or lianabrown@trentu.ca

11. Compensation:
Participants will receive $10 to compensate for costs of transportation and parking.

If I have comments or concerns resulting from my participation that I do not feel comfortable talking about with the Faculty Investigator. I understand that I can contact the Board of Ethics by phoning Anna Kisiala at 705-748-1011 ext. 7896 or emailing researchintegrity@trentu.ca.

Appendix K

Consent Form

DEPARTMENT OF PSYCHOLOGY
Action & Cognition @ Trent (ACT) Lab
actlab.trent@gmail.com

Emma Pownall, B.Sc. Kin
Psychology Graduate Student
Telephone: (705)-772-2519
Email: emmapownall@trentu.ca

Liana E. Brown, Ph.D.
Associate Professor
Telephone: (705)-748-1011 x7238
Fax: (705)-748-1580
Email: lianabrown@trentu.ca

Questionnaire Consent Form

Project Title: Emotional Appraisal and Acceptance and Commitment in Concussed Athletes: A Mixed Methods Study
Master's Student Investigator: Emma Pownall, B.Sc. Kin
Faculty Investigators: Liana E. Brown, Ph.D.

I have read the letter of information and have had the nature of the study explained to me. All questions have been answered to my satisfaction. I understand that all the procedures for this study have been reviewed and received clearance from the Board of Ethics at Trent University **(13604)**. If I have comments or concerns resulting from my participation that I do not feel comfortable talking about with the Faculty Investigator. I understand that I can contact the Board of Ethics by phoning Anna Kisiala at 705-748-1011 ext. 7896 or emailing researchintegrity@trentu.ca.

In one of our questionnaires you will be asked how often you have had, "Thoughts that you would be better off dead or hurting yourself in some way". If you indicate that you have felt this way "more than half the days" or "nearly everyday" we have a duty to report this as an indication of self-harm. In this case, we would call Trent University Security and follow their direction. This is the same instruction provided to all members of the University community to follow if they are presented with a person indicating a willingness to self-harm. We have added resources below for you to contact if you find any of the testing distressing. If at any point, now or in the future, you experience a willingness to self-harm, we strongly encourage you to reveal these thoughts to family or friends, one of the organizations we have listed below, police, ambulance, fire, or to go to the emergency department at the hospital. Help is available.

By signing below, I consent to participate in this study. I understand that I may withdraw this consent two weeks after completion by telling the researcher.

☐ I have read, or have had read to me, the information in this agreement;
☐ I have asked any questions I have about the study;
☐ By signing, I agree to participate in the study;
☐ I am aware I can change my mind and withdraw consent to participate at any time;
☐ I have been given a copy of this agreement; and
☐I am not giving up any legal rights by signing this consent agreement.
☐ I am aware that the researcher will not use my name, but a participant code when discussing my contributions in their report;

Participant:

_____ _____
Signature Date

_____
Print Name

Experimenter:
I certify that the informed consent procedure has been followed and that I have answered any questions from the participant above as fully as possible.

_____ _____
Signature Date

_____
Print Name

If you are looking for help dealing with your concussion, you can access resources available to you in Peterborough through the PACA website:
PACA: https://www.paca.health/resources/
Education: https://cattonline.com/
Policy: https://www.ontario.ca/page/rowans-law-concussion-safety
Mental Health: https://cmhahkpr.ca/
Recovery & Support: https://www.headsupcan.ca/sharing-experiences-with- concussion/tbi

Appendix L

Participant Athletic and Demographic Information

Participant Number	Age	Sex	Sport	Physician Diagnoses	Total Recovery Time (days)	Frequently Reported Symptoms	Number of Prior Concussions
1	20	F	Lacrosse	Yes	20	Dizziness headache	0
2	17	F	Track and Field	Yes	30	Headaches, sensitivity	2
3	32	M	Rugby	No	12	Pressure	3
4	32	M	Football	No	30	Emotional	6
5	19	M	Hockey	Yes	60	Headaches, sensitivity	3
6	42	M	Hockey	Yes	45	Headaches, fatigue, nausea	1
7	21	M	Hockey	Yes	28	Brain fog, disorientation	0
8	17	M	Hockey	Yes	43	Dizziness, nausea, sensitivity	5
9	25	M	Hockey	Yes	21	Brain fog, fatigue, unmotivated, sensitivity	3
10	17	M	Hockey	Yes	27	Visual	1
11	16	M	Hockey	Yes	17	Visual, sensitivity	5
12	17	M	Hockey	Yes	76	Headaches, foggy brain, sensitivity, visual	2
13	16	M	Hockey	Yes	30	Headaches	0
14	25	M	Football	Yes	30	Headaches, irritability	5
15	17	M	Lacrosse	Yes	10	Fatigue headaches, emotions	2
16	16	M	Lacrosse	Yes	21	Sensitivity, headache, dizziness	0
17	19	M	Rugby	Yes	21	Headaches, nausea, sensitivity, neck pain	4
18	21	M	Lacrosse	No	3	Headaches, fatigue, brain fog	0
19	16	M	Hockey	Yes	12	Headache	0
20	21	M	Lacrosse	Yes	10	Sensitivity, irritable	1
21	18	M	Rugby	No	14	Sensitivity, nausea, fatigue	1
22	17	M	Basketball	No	21	Sensitivity	2
23	23	F	Soccer	No	28	Headache, sensitivity, pressure, neck pain nausea	0
24	25	M	Lacrosse	Yes	45	Sensitivity, high heart rate	2
25	25	M	Lacrosse	Yes	43	Headaches, sensitivity, brain Fog,	2
26	23	F	Rugby	No	14	Headaches, Fatigue	2
27	24	M	Baseball	Yes	28	Sensitivity	1
28	22	F	Lacrosse	No	7	Headaches	3
29	17	F	Soccer	Yes	60	Headaches	1
30	19	F	Rugby	Yes	30	Sensitivity	2

Note. This table presents demographic and athletic information for study participants, including age, sex, sport, physician diagnoses, total recovery time, frequently reported symptoms, and number of prior concussions. Symptoms have been coded, with common issues including headaches, dizziness, and sensitivity to light. Recovery times vary, ranging from 3 to 76 days.

Appendix M

Correlation Table with Confidence Intervals

	AGE	RECOVERY TIME	NUM PRIOR CON	SCAT TOTAL	SCAT SEV	ACLRSI	APSQ	GAD	PHQ	ACT PRE	ACT POST	ACT CHANGE
AGE												
RECOVERY TIME	0.072 [-0.306, 0.431]											
NUM PRIOR CON	0.241 [-0.142, 0.561]	0.156 [-0.227, 0.497]										
SCAT TOTAL	-0.032 [-0.403, 0.349]	0.385 [0.010, 0.665]	0.280 [-0.108, 0.594]									
SCATSEV	-0.032 [-0.404, 0.348]	0.431 [0.066, 0.695]	0.387 [0.013, 0.666]	0.893 [0.778, 0.950]								
ACLRSI	-0.110 [-0.467, 0.278]	-0.053 [-0.421, 0.330]	-0.203 [-0.538, 0.187]	0.167 [-0.224, 0.511]	0.061 [-0.323, 0.428]							
APSQ	0.003 [-0.387, 0.393]	0.293 [-0.109, 0.613]	0.233 [-0.173, 0.571]	0.575 [0.238, 0.788]	0.589 [0.258, 0.796]	-0.137 [-0.500, 0.268]						
GAD	-0.050 [-0.439, 0.355]	0.204 [-0.211, 0.556]	0.200 [-0.214, 0.554]	0.502 [0.130, 0.750]	0.512 [0.143, 0.755]	-0.339 [-0.649, 0.067]	0.703 [0.424, 0.860]					
PHQ	-0.172 [-0.533, 0.242]	0.348 [-0.058, 0.655]	0.247 [-0.167, 0.587]	0.704 [0.425, 0.860]	0.663 [0.360, 0.839]	-0.323 [-0.639, 0.085]	0.714 [0.442, 0.866]	0.678 [0.383, 0.847]				
ACT PRE	-0.218 [-0.567, 0.196]	0.096 [-0.313, 0.476]	0.008 [-0.391, 0.404]	0.182 [-0.233, 0.540]	0.165 [-0.249, 0.528]	-0.074 [-0.458, 0.333]	0.471 [0.090, 0.731]	0.425 [0.033, 0.704]	0.373 [-0.029, 0.671]			
ACT POST	-0.211 [-0.561, 0.204]	0.091 [-0.318, 0.471]	0.173 [-0.241, 0.534]	0.064 [-0.342, 0.450]	0.063 [-0.343, 0.450]	-0.305 [-0.627, 0.105]	0.274 [-0.139, 0.606]	0.359 [-0.045, 0.662]	0.323 [-0.085, 0.639]	0.812 [0.613, 0.915]		
ACT CHANGE	-0.016 [-0.411, 0.384]	-0.013 [-0.408, 0.387]	-0.292 [-0.618, 0.119]	-0.166 [-0.529, 0.248]	-0.230 [-0.575, 0.185]	0.218 [-0.197, 0.566]	0.228 [-0.187, 0.573]	0.051 [-0.354, 0.439]	-0.169 [-0.531, 0.245]	0.261 [-0.153, 0.597]	-0.189 [-0.546, 0.225]	

Appendix N

A Qualitative Approach

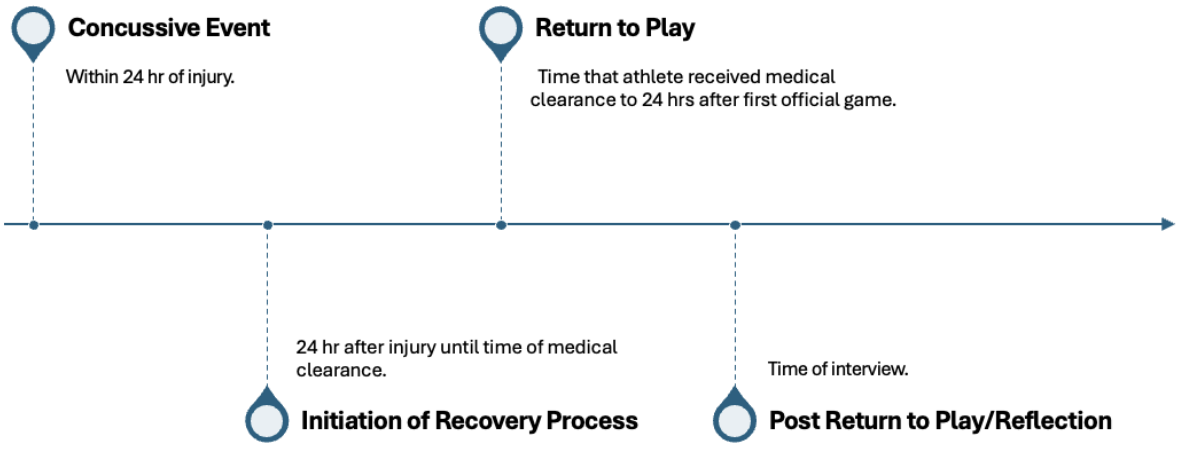
Research Design

The researcher had planned to use a mixed methods approach to investigate thoughts, feelings, and behaviours of the recovery and RTP process through an ACT lens. The study was designed in a way that the participants would complete the structured surveys and would contact the primary researcher if they were interested in completing a semi-structured interview. Although 30 people agreed to complete the quantitative survey, none of them agreed to the interview.

The objective of the qualitative aspect of this research study was to provide participants with a voice and the opportunity to offer deeper insights and context towards the recovery process. Using a mixed-methods approach allows for an in-depth understanding of how athletes emotionally appraise concussive events. The qualitative component captures diverse perspectives and experiences, while the quantitative component quantifies these findings.

Figure 4

Timeframe of Critical Events as Broken Down in the Interview



Note. This timeframe illustrates the sequence of critical events that happen throughout recovery, including important aspects of the return-to-play protocol.

Table 9

Interview Framework Example

Section	Purpose	Example Questions	Rational
1: Background Information	To understand the participant's athletic identity, level of competition, and personal outlook on competition.	What made you interested in being involved in this study? Can you briefly describe your athletic background, including your level of competition?	This section contextualizes the participant's experience by highlighting their athletic background and motivations, which will frame the concussion's impact.
2: Concussion as Critical Event #1	To explore the immediate experience of sustaining a concussion, including initial thoughts, emotions, and responses.	Can you describe the circumstances surrounding the event of your concussion (first 24 hours)? What were some of the immediate thoughts when you realized you had sustained a concussion?	This section captures the participant's immediate responses to the concussion event, including emotional and social impacts.
3: Initiation of Recovery Process as Critical Event #2	To understand the participant's experiences and challenges during the early stages of recovery.	Can you describe your journey through the recovery process (from the point of injury until just before RTP)? What were some of the thoughts or emotions you had when you began your recovery process?	This section focuses on recovery experiences, emphasizing the psychological, social, and functional impacts.
4: Return to Play as Critical Event #3	To explore the transition from recovery to returning to play, highlighting thoughts, emotions, and influencing factors.	What was your experience between returning to practice with no contact versus returning to practice with contact? Can you describe your experience with a complete return to competition?	This section examines the participant's re-entry into athletic competition and its effects on their overall well-being.
5: Complete/Post Return to Play as Critical Event #4	To reflect on the entire experience of concussion and recovery, capturing broader insights and lessons learned.	Having now made a complete return to play and being able to reflect on your experiences, how would you describe the overall experience? What did you value most throughout the whole incident?	This section examines the participant's re-entry into athletic competition and its effects on their overall well-being.
6: Reflecting on Experience/Closing	To capture any additional insights or unaddressed aspects of the participant's experience.	Is there anything else you would like to share regarding your experience that we haven't covered in this interview?	This section ensures all aspects of the participant's journey are covered, providing a space for any final thoughts.

Appendix O

Interview Protocol

Preamble

This interview will focus on your experience with concussion and return to play. The interview will take approximately 90 minutes. If you feel fatigued, we can take a break or stop and resume the interview at another time. There are no right or wrong answers, we are solely interested in your experience as it unfolded throughout this process. There are 6 sections in the interview, covering (1) background information pertaining to your experience as an athlete, (2) the incident of the concussion, (3) your progression through the recovery process, (4) the complete return to sport, (5) reflection on the complete return to sport and whole experience of the injury, and (6) any closing remarks.

Do you have any questions?

Do I have your consent to proceed?

Section 1: Background Information

In this section, we will be exploring your experience and perceptions of yourself as an athlete to get a better understanding of your experience, behaviours, values, and challenges.

1. What made you interested in being involved in this study?
2. Can you briefly describe your athletic background, including your level of competition?
3. How do you describe yourself as a competitor?
    a. What image do you have of yourself as a competitor? (self)
    b. What does that look like to teammates/coaches/opponents? (behaviour)

4. What makes you passionate about competition? (values)
5. Alternatively, what challenges do you face as a competitor? (internal experiences - away)

Section 2: Concussion as Critical Event #1

In this section, we would like to discuss the initial event of the concussion. We define this event as the point in time in which you sustained the concussion and approximately 24 hours after the injury. We will be asking you questions surrounding how it happened, immediate effects on your functioning, if any, and how you perceived and coped.

1. Can you describe the circumstances surrounding the event of your concussion?
2. How did you respond to your injury?
    a. How did the concussion affect your day-to-day function? (overt behaviours)
        i. Sport participation
        ii. School/work
        iii. Self-care/activities of daily living
        iv. Social/leisure
    b. What immediate thoughts or emotions came up for you when you realized you had sustained a concussion? (covert behaviours)
        i. What about when you realized the consequences?
    c. How did those around you respond to your concussion? I.e., Teammates, coaches, parents, and friends.
        i. How did your coach and athletic staff assist with the immediate concussive event?

ii. Were there specific supportive measures that stood out?

iii. What was less helpful?

3. What were your priorities when you initially sustained your concussion? (values)
4. What bothered or distressed you the most during the immediate period? (challenges)
    a. How did you cope with this challenge?
    b. What worked?
    c. What didn't?
5. What changes about yourself did you notice in the period immediately after your concussion?
    a. Did you feel differently about yourself? If so, how?
    b. What would those around you say?
6. Is there anything more you would like to say about your initial concussion experience; anything you feel like you have left out, or hasn't been expressed well?

Section 3: Initiation of Recovery Process as Critical Event #2

In this section, we will explore your progress through recovery. The recovery timeline is viewed as the 24-hour period following the concussive event to the point right before you were cleared to return to competition.

1. Can you describe your journey through the recovery process (from the point of injury until just before RTP)?
2. How did you respond to recovery process?

a. How did the recovery process affect your day-to-day function? (overt behaviours)
    i. Sport participation
    ii. School/work
    iii. Self-care/activities of daily living
    iv. Social/leisure
    v. Treatment

a. What were some of the thoughts or emotions you had throughout the recovery process?
    i. What about when you realized consequences?

b. How did those around you respond/react? I.e., Teammates, coaches, parents, and friends.
    i. How did your coach and athletic staff assist you in the recovery process?
    ii. Were there specific supportive measures that stood out?
    iii. What was less helpful?

3. What were your priorities as your progressed through recovery? (values)
4. What aspects were most challenging/distressing to you throughout the recovery process?
    a. What did you miss the most?
    b. How did you cope with these challenges?
        i. What worked?
        ii. What didn't?

5. What changes about yourself did you notice during the recovery period?
    a. Did you feel differently about yourself? How?
    b. What would those around you say?
6. Is there anything more you would like to say about the recovery period; anything you feel like you have left out, or hasn't been expressed well?

Section 4: Return to Play as Critical Event #3

In this section, we will be exploring your complete return to competition. We are specifically interested in the time when you received medical clearance to the time you participated in your first game in addition to approximately 24 hours after this first game.

1. Can you talk about your return to competition? What was your experience when you were cleared to play up until you participated in your first game back?
    a. What was the difference between returning to practice with no contact vs returning to practice with contact?
    b. Did you experience any symptoms?
    c. What were your thoughts and feelings during this phase of recovery/return to play?
    d. Did you/do you have any second thoughts about RTP?
2. What influenced your decision to return to play?
    a. How did return to play process affect your day-to-day function and well-being?
        i. School/work
        ii. Self-care/activities of daily living

iii. Social/leisure

iv. Treatment

b. What were some of the thoughts or emotions you had when returned to competition?

i. What about when you realized consequences?

c. How did those around you respond to your efforts? I.e. Teammates, coaches, parents, friends

i. How did your coach and athletic staff assist you in the return to play process after your concussion?

ii. Were there specific supportive measures that stood out?

iii. What was less helpful?

3. To what extent did the complete return to play process affect your relationships (social well-being)? I.e., Teammates, coaches, parents, and friends.
4. What were your priorities or what was important to you about returning to competition?
5. What aspects were most challenging/distressing to you throughout the recovery process?
    a. What was most difficult for you during the complete return to play?
    b. How did you cope with said challenge or stressor?
        i. What worked?
        ii. What didn't?
6. What changes about yourself did you notice during the return to play period?
    a. Did you feel differently about yourself? How?

b. What would those around you say?

7. Is there anything more you would like to say about your return to play experience; anything you feel like you have left out, or hasn't been expressed well

Section 5: Complete/Post Return to Play as Critical Event #4

In this last section, we will be reflecting on the full aspects of return to play. Now having been back in competition for a span of time we want you to think back to overall experience of the concussion, recovery, and return to play; recalling the overall experience.

1. Having now made a complete return to play and being able to reflect on your experiences, how would you describe the overall experience?
2. Looking back, what were some of the thoughts or emotions you had when you began your recovery process?
    a. To what extent did the recovery process affect your day-to-day function (cognitive well-being)?
        i. School/work
        ii. Self-care/activities of daily living
        iii. Social/leisure
        iv. Treatment
    b. To what extent did the recovery process affect your relationships (social well-being)? I.e., Teammates, coaches, parents, and friends.
        i. How did your coach and athletic staff assist you in the recovery process after your concussion?
        ii. Were there specific supportive measures that stood out?

iii. What was less helpful?

3. What did you value most throughout the whole process?
4. What was most difficult for you throughout the whole process? (challenges)
    a. How did you cope with said challenge or stressor?
        i. What worked?
        ii. What didn't?
7. What have you learned about yourself going through this process?
    c. Do you feel differently about yourself? How?
    d. What would those around you say?
8. Is there anything more you would like to say about your concussion, recovery and return to play experience; anything you feel like you have left out, or hasn't been expressed well?

Section 6: Reflecting on Experience/Closing/Debrief

Lastly, we want to close of the interview with a few questions that offer some insight to your experience and identify any areas of particular significance or interests to you. Your feedback is valuable in shaping our understanding.

1. When during the interview did you feel listened to and understood?
2. Are there things you learned, insights you gained, or new perspectives taken during the interview?
3. What were the most interesting questions and prompts from me?
4. Is there anything else you would like to share regarding your experience with concussions, mental health, or support systems that we haven't covered in this interview?

Appendix P

Letter of Information – Interview

DEPARTMENT OF PSYCHOLOGY
Action & Cognition @ Trent (ACT) Lab
actlab.trent@gmail.com

Emma Pownall, B.Sc. Kin
Psychology Graduate Student
Telephone: (705)-772-2519
Email: emmapownall@trentu.ca

Liana E. Brown, Ph.D.
Associate Professor
Telephone: (705)-748-1011 x7238
Fax: (705)-748-1580
Email: lianabrown@trentu.ca

Letter of Information - Interview

Project Title: Emotional Appraisal and Acceptance and Commitment in Concussed Athletes: A Mixed Methods Study
Graduate Student Investigator: Emma Pownall, B.Sc. Kin
Faculty Investigators: Liana E. Brown, Ph.D.

0. Purpose:
The purpose of the current study is to learn more about an athlete's perception of their mental health as they recover from a concussion and return to play.

1. Participation inclusion/exclusion criteria:
To participate in the study:
- All individuals are required to be competing in a sport.
- All individuals must be between the ages of 16 to 60.
- All participants need to have sustained a concussion that removed them from play.
- All participants must have completed the return to play process within the last three months.
- All participants should be otherwise considered healthy.

We cannot allow you to participate if you:
- Have been diagnosed with a short or long-term condition that could affect their participation in daily life.
- Have been diagnosed with neurological dysfunction that was not caused by the concussion.

2. Procedures to be followed:
We would like you to participate in a semi-structured interview. The interview will focus on your experience of mental health throughout your return to play. I will be asking you questions about the effect of the concussion on different aspects of your well-being, the stressors you experienced, and coping strategies you tried and how well they worked. The interview will take place in person or via Zoom. The primary researcher will obtain written or verbal consent should you choose to participate

3. Time duration of the procedures and study:
Your participation in this research will involve 2 hours in total.

4. Benefits to you:
By participating in this research, you will get a chance to tell us about and reflect on your concussion.

5. Benefits to society:
Concussions are complex injuries that are frequently misunderstood. This research will help us better understand how an athlete's feelings, coping strategies, and support systems contribute to their recovery and return to play.

6. How the data will be used:

The researchers declare that they have no potential conflicts of interest: we will not experience any specific personal or financial gain or loss from the results of this experiment. The researcher has no plan currently to develop a for-profit venture from the findings of this research.

7. Voluntary participation:
Your participation is entirely voluntary. You are free to stop participating in the research at any time or to decline to answer any specific questions without loss of promised compensation. To withdraw from the experiment, you simply need to inform the investigator of your wish to withdraw by email or by telephone.

Should you choose to withdraw your data from the study, you will have two weeks following competition to contact the primary researcher to withdraw free of penalty.

8. Statement of confidentiality:
Your participation in this research is entirely confidential. Only the primary investigator (Emma Pownall) will have access to identifying information. To make sure that participation is confidential, individuals' data will be distinguished by a code number and only the person(s) in charge will have access to the materials that link names to the code. If this research is published, no personally identifying information will be disclosed. Five years after the data are published all identifying paperwork will be shredded and deleted.

It is becoming more and more common for researchers to share their data sets with other researchers. We will share only a de-identified version of our data and it will be made available only to other researchers or research trainees.

9. Discomforts and risks:
Please be assured that the interviews are designed to document your experience. This experience may be uncomfortable or stressful to recall. Some individuals may find the questions frustrating or hard to talk about. Remember that you are free to refuse to answer any question or to withdraw at any time. Should you want or need additional concussion and mental health resources please refer to the links below.
PACA: https://www.paca.health/resources/
Education: https://cattonline.com/
Policy: https://www.ontario.ca/page/rowans-law-concussion-safety
Mental Health: https://cmhahkpr.ca/
Recovery & Support: https://www.headsupcan.ca/sharing-experiences-with- concussion/tbi

10. Post-experiment feedback and right to ask questions:
You will be given an opportunity to ask any questions that you may have, and all such questions or inquiries will be answered to your satisfaction. We will answer any questions you have at any time, before, during, or after the study is completed. If you have questions in the future, you are welcome to contact Emma Pownall at emmapownall@trentu.ca or Liana Brown at 705-748-1011 x7238 or lianabrown@trentu.ca

11. Compensation:
Participants will receive $10 to compensate for costs of transportation and parking.

If I have comments or concerns resulting from my participation that I do not feel comfortable talking about with the Faculty Investigator. I understand that I can contact the Board of Ethics by phoning Anna Kisiala at 705-748-1011 ext. 7896 or emailing researchintegrity@trentu.ca.

Appendix Q

Consent Form – Interview

DEPARTMENT OF PSYCHOLOGY
Action & Cognition @ Trent (ACT) Lab
actlab.trent@gmail.com

Emma Pownall
Master's of Psychology
Telephone: (705)-772-2519
Email: emmapownall@trentu.ca

Liana E. Brown, Ph.D.
Associate Professor
Telephone: (705)-748-1011 x7238
Fax: (705)-748-1580
Email: lianabrown@trentu.ca

Interview Consent Form

Project Title: Emotional Appraisal and Acceptance and Commitment in Concussed Athletes: A Mixed Methods Study
Master's Student Investigator: Emma Pownall
Faculty Investigators: Liana E. Brown, Ph.D.

I have read the letter of information and have had the nature of the study explained to me. All questions have been answered to my satisfaction. I understand that all the procedures for this study have been reviewed and received clearance from the Board of Ethics at Trent University **(13604)**. If I have comments or concerns resulting from my participation that I do not feel comfortable talking about with the Faculty Investigator. I understand that I can contact the Board of Ethics by phoning Anna Kisiala at 705-748-1011 ext. 7896 or emailing researchintegrity@trentu.ca.

I understand that my interview responses will be audio recorded (if the interview is conducted in person) or audio/video recorded (if the interview is conducted remotely, e.g. using Zoom).

By signing below, I consent to participate in this study. I understand that I may withdraw this consent two weeks after completion by telling the researcher.

☐ I have read, or have had read to me, the information in this agreement;
☐ I have asked any questions I have about the study;
☐ By signing, I agree to participate in the study;
☐ I am aware I can change my mind and withdraw consent to participate at any time;
☐ I have been given a copy of this agreement; and
☐I am not giving up any legal rights by signing this consent agreement.
☐ I am aware that the researcher will not use my name, but a participant code when discussing my contributions in their report;
☐ I agree to be [audio, video, or both] recorded for the purposes of this study. I understand how these recordings will be used, stored and destroyed.

Participant:

_____ _____
Signature Date

_____
Print Name

Experimenter:
I certify that the informed consent procedure has been followed and that I have answered any questions from the participant above as fully as possible.

_____ _____
Signature Date

_____
Print Name

If you are looking for help dealing with your concussion, you can access resources available to you in Peterborough through the PACA website:
PACA: https://www.paca.health/resources/
Education: https://cattonline.com/
Policy: https://www.ontario.ca/page/rowans-law-concussion-safety
Mental Health: https://cmhahkpr.ca/
Recovery & Support: https://www.headsupcan.ca/sharing-experiences-with- concussion/tbi