Psychological Aspects of Anterior Cruciate Ligament Injuries

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Linköping University Post Print

N.B.: When citing this work, cite the original article.

Original Publication:
Clare Ardern, Joanna Kvist and Kate E. Webster, Psychological Aspects of Anterior Cruciate Ligament Injuries, 2016, Operative techniques in sports medicine, (24), 1, 77-83.
http://dx.doi.org/10.1053/j.otsm.2015.09.006
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http://www.elsevier.com/

Postprint available at: Linköping University Electronic Press
http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-126832
Psychological aspects of ACL injuries

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Abstract

Impairment-based evaluation has, until recently, been the mainstay of orthopaedic research in anterior cruciate ligament (ACL) reconstruction. However, participation-based outcomes, in particular returning to sport, have lately garnered increased research attention. This is important because returning to sport is typically a main concern of injured athletes. Recent meta-analyses have demonstrated that the return to sport rate after ACL reconstruction is disappointingly low, and that a range of contextual factors including age, sex, sport participation level and psychological factors may affect the return to sport rate. Moderate to large effect sizes have been demonstrated for greater psychological readiness to return to sport, and lower fear of re-injury favouring returning to the pre-injury level sport after ACL reconstruction.

Understanding the relationship between psychological factors and returning to sport is essential in light of the fact that most athletes recover good physical function after surgery, and many athletes with good knee function do not return to sport.

Psychological factors are potentially modifiable with appropriate intervention, yet these factors are not systematically addressed in routine post-operative rehabilitation.

This review summarises the recent evidence for the relationship between psychological factors and ACL injury, including recovery from injury and returning to sport.
An anterior cruciate ligament (ACL) rupture is one of the most common sports-related injuries to the knee. In contemporary orthopaedics, athletes who wish to return to sport are typically advised to have ACL reconstruction surgery plus post-operative rehabilitation to facilitate a safe return to sport and are usually absent from sports participation for between 6 and 12 months after surgery.

A ruptured ACL was once considered career ending for athletes. With the introduction of non-invasive surgical techniques and accelerated rehabilitation protocols, knee function outcomes improved, and with this came increased expectations of a successful return to the pre-injury level of sports participation. Patients also have high expectations of ACL reconstruction in terms of recovery of knee function, conceivably driven by continual advances in surgery and rehabilitation, and media coverage. To meet these expectations of function and participation requires considerable commitment to rehabilitation, and being mentally prepared for an extensive and involved recovery period.

Until recently, the focus of orthopaedic research in ACL reconstruction has been on evaluating impairment-based outcomes after surgery. This is despite the fact that a key concern for athletes is returning to participation in sport, and a lack of association between knee impairments and function. Many athletes with good knee function do not return to their previous level of sports participation after ACL reconstruction, and the rate of return to the pre-injury level and competitive sport is disappointingly low. This has led researchers to question whether there are other factors that may impact on returning to sport after surgery.

After injury, athletes often report anger, depression, anxiety, a lack of confidence and fear of sustaining a new injury. There is also evidence that these psychological
Disturbances may affect recovery \textsuperscript{16-18} and returning to sport,\textsuperscript{16,19} as well as increase the risk of sustaining a new injury.\textsuperscript{20,21} Recovery from sports injury is influenced not only by physical factors, but also by psychological factors.\textsuperscript{19,22} This means that to successfully transition back to sport after injury athletes need to be physically as well as psychologically ready; yet these states often do not coincide.\textsuperscript{19,22}

There has been increased research attention paid to evaluating the impact of psychological factors on outcomes after athletic injury. Therefore, the aim of the present review was to review and summarise the evidence for associations between psychological factors and returning to sport following ACL reconstruction.

**Theoretical perspectives**

Dysfunctional psychological responses to injury are hypothesised to persist due to combinations of and interactions between biological, environmental, and psychosocial factors.\textsuperscript{23} Similarly, returning to sport after injury is complex and multifactorial – directly and indirectly influenced by a range of physical, contextual and psychological factors (Figure 1).\textsuperscript{13,19,24-26} To account for the myriad factors and complex relationships between these factors, biopsychosocial models have been proposed.\textsuperscript{18,27}

In these models, psychological factors are hypothesised to have a central mediating role on physical factors (impairments of body structure including muscle strength, pain, stability, swelling and movement), social/contextual factors (e.g. recovery expectations and quality of life), functional performance (including aspects of motor control such as balance), and ultimately on returning to sport (Figure 1). A strength of the biopsychosocial model is that it specifies pathways through which psychological factors impact on treatment outcomes.\textsuperscript{28} In addition, the characteristics of an injury, such as the cause, severity, and type; and sociodemographic factors, such as age, sex,
ethnicity and socioeconomic status, are hypothesised to indirectly influence returning to sport via their impact on physical, psychological and social/contextual factors (Figure 1). The potential for psychological factors to influence returning to sport after injury via a range of different pathways is illustrated in Figure 1, and underscores the importance of understanding and addressing psychological factors as part of the management of ACL injury.

Figure 1 about here

Psychological response to athletic injury

An athlete’s response to psychological stress is hypothesised to play a major role in injury occurrence; and the perception of stress is likely to be influenced by a range of athlete-related factors including personality, available coping resources, and history of stressors (both physical and psychological). The athlete’s psychological stress response may also continue long after the injury has occurred. Subsequently, the response to stress influences the athlete’s cognitive appraisal of their injury. The cognitive appraisal directly affects an athlete’s emotional response and ultimately their behaviour. Therefore, the chain of psychological sequelae to injury could conceivably have an impact on rehabilitation and return to sport outcomes. For example, effective coping strategies could translate to an improved prognosis for recovery if the athlete is more adherent to rehabilitation, and as a result, able to return to function faster and with fewer debilitating psychological responses.

Heightened negative emotional responses, including shock, frustration, depression, boredom, tension and anger, have been reported immediately after athletic injury and during recovery from injury. Conversely, injury may also be associated with positive emotions, with some injured athletes reporting feeling relieved after
sustaining an injury because they are no longer under pressure to perform. The psychological response may also be linked to athletes’ sense of athletic identity, with athletes who were more involved in their sport conceivably having a stronger emotional response to athletic injury as a result of their greater investment in sports participation. In a study of professional Australian Rules Football players, those who had severe injuries that potentially threatened their future performance or career reported a stronger negative psychological response compared to those who saw their injury as more minor. The nature and duration of the injury were key factors that impacted on athletes’ psychological responses to injury, along with a perception of isolation from the team while undertaking rehabilitation, being sidelined from the team and the game, and the extent of social support from medical staff, team mates and family. In the early post-operative phase after ACL reconstruction, significant reductions in kinesiophobia and pain catastrophising, and significant increases in self-efficacy for rehabilitation have been demonstrated. The increase in self-efficacy was found to be associated with a reduction in knee pain intensity. Improved self-efficacy and reduced kinesiophobia were also associated with improved knee function. These findings suggest that psychological factors may have an important influence on recovery early after ACL reconstruction; although this is not to discount the likely impact of early physical recovery on psychological responses. The findings also suggest that psychological interventions, particularly aimed at addressing self-efficacy and kinesiophobia early in the post-operative phase, may have the potential to contribute to improved short-term rehabilitation outcomes after ACL reconstruction.
How do psychological factors influence sport injury rehabilitation?

Recovery of sufficient physical capacity to safely participate in sport after injury is vital, and well addressed by physical rehabilitation. Systematic reviews have shown that the majority of patients achieve good physical recovery after ACL reconstruction, based on standard outcomes that measure aspects of function important for successful performance of sport. Key milestones in rehabilitation after ACL reconstruction are restoration of knee joint motion and muscle function, independent function in daily activities including employment, sport-specific training, and re-establishment of an athletic identity. Although the primary concern of most athletes is returning to sport.

Psychological responses are prominent during rehabilitation, and make an important contribution to the overall quality and progression of rehabilitation. Emotions change over time during the rehabilitation period, and the emotional response has been linked to an individual’s sense of athletic identity. While negative emotional responses immediately after the injury have been reported, the literature demonstrates a consistent improvement in psychological responses as rehabilitation progresses. However, for some athletes, the response may become more negative around the time of clearance to return to sport and when they are making the transition back to sport.

Morrey et. al. found that athletes’ emotional responses to ACL injury and reconstruction followed a U-shaped progression through rehabilitation, with peaks in the negative responses immediately following injury and at the time of clearance to return to sport (at 6 months post-operative). In contrast to Morrey’s et. al. findings of a U-shaped emotional response, Langford et. al. found athletes’ emotional
responses and psychological readiness to return to sport improved linearly over time during rehabilitation, and psychological readiness to return to sport at 6 months after surgery predicted returning to the pre-injury level sport at 1 year. Self-efficacy has also been found to significantly improve as people progress through post-operative rehabilitation, and there are correlations between self-efficacy and knee symptoms and function (measured with the Knee Injury and Osteoarthritis Outcome Score) after 3, 6, and 12 months of rehabilitation.

How do psychological factors influence returning to sport?

Athletes undergoing ACL reconstruction and their treating clinicians typically expect a successful return to sport to following surgery. However, while surgery addresses the underlying impairments in knee function, this does not always translate to a successful return to sport – one in every three athletes do not return to their pre-injury level sport after surgery. Non-modifiable contextual factors have been found to be associated with returning to the pre-injury level sport following ACL reconstruction, including being young, male, and playing elite level sport prior to injury. Psychological responses are potentially modifiable factors that have also been shown to be associated with returning or not returning to the pre-injury level sport after surgery. Psychological factors may conceivably be modifiable with specific interventions, and it could be hypothesised that addressing these factors could have an impact on returning to sport.

The extent to which an individual feels their engagement in a particular behaviour is freely chosen, that they have the necessary competence to successfully complete the behaviour, and perceive a meaningful connection to others as a result of engaging in a behaviour is theorised to directly impact on the likelihood of an individual engaging
in a behaviour.⁴⁷ These autonomy, competence and relatedness constructs, when fulfilled, increase self-motivation to engage in a particular behaviour.⁴⁷ When applied to the return to sport context, there is evidence that athletes who feel they have greater personal control over their return to sport (autonomy), have greater confidence in their body (competence), and feel more socially connected to teammates (relatedness) are more likely to return to their previous level of sport.¹⁹ In addition, motivation, confidence, self-efficacy, optimism and lower fear of a new injury are psychological factors that have been associated with the likelihood of returning to the pre-injury level following athletic injury³ and ACL reconstruction.²⁵, ²⁶, ³⁹

Anxiety about the risk of sustaining a new injury has been identified as a prominent emotional response of athletes around the time that they are transitioning from rehabilitation back to full participation in sport after serious injury.¹⁴, ⁴⁸ Emotional responses are particularly powerful for athletes who sustain a serious injury,¹⁴ and are a strong influence on an athlete’s decision to return to sport or not.⁴⁹-⁵¹ While some athletes use fear as a motivation during the return to sport transition, with the fear dissipating when the injured body part is tested and holds up in competition; for others, the fear of a new injury can hinder their return to sport.²³, ⁵² While poor or inadequate rehabilitation after ACL reconstruction may negatively impact returning to sport as athletes may lack the physical capabilities to safely and effectively participate at their optimum level, the most common reason that athletes give for not returning to their previous level of sport after surgery is fear of sustaining a new injury.¹² Adding further weight to the notion of fear of re-injury being a key psychological factor impacting on returning to sport after ACL reconstruction, a recently published meta-analysis demonstrated a moderately large effect (standardised mean difference 0.7)
for low fear of re-injury (measured with the Tampa Scale for Kinesiophobia\textsuperscript{53})

favouring returning to the pre-injury level sport following surgery.\textsuperscript{24}

Meta-analysis has demonstrated large effects (standardised mean difference 0.9) for psychological readiness to return to sport (measured with the ACL-Return to Sport after Injury scale\textsuperscript{54}) favouring returning to the pre-injury level sport after surgery.\textsuperscript{24} In a recent qualitative investigation by Podlog et. al.,\textsuperscript{55} psychological readiness to return to sport was suggested by athletes to be multi-dimensional and comprise three key dimensions that increased their perceived likelihood of successful return: confidence in returning to sport, realistic expectations of sporting capabilities, and motivation to regain the pre-injury performance standards.\textsuperscript{55} Athletes reported that their confidence to return to sport was strongly influenced by their belief in the rehabilitation they completed, their perception that the injured body part was completely healed and no longer susceptible to re-injury, and that performance at the same pre-injury level was possible.\textsuperscript{55}

Given the prospective associations between psychological factors and returning to sport, it may be reasonable to hypothesise that addressing psychological factors during rehabilitation could be a way to help injured athletes maximise their chances of returning to the pre-injury level sport. However, current rehabilitation after ACL reconstruction focuses on physical recovery and helping athletes recover the physical capacity to participate in sport. Despite this, many do not return to sport. Therefore, a re-evaluation of current rehabilitation programs may be needed to incorporate interventions that address confidence and psychological readiness to return to sport after surgery.
Competitive athletes reported that recovery of physical capacity to manage a return to
sport was a key part of building confidence to return, suggesting an inter-
relationship between physical and psychological readiness to return to sport. This
supports the notion that to optimise the likelihood of returning to sport, rehabilitation
should systematically address both physical and psychological factors. Interventions to address psychological factors could conceivably influence an
athlete’s confidence. For example, goal setting, education, modelling and rapport
building strategies could help to improve self-efficacy of rehabilitation and
confidence in the injured knee. Imagery and relaxation training may help to
allay fears of re-injury and improve self-confidence in performance. On the
other hand, it could also be argued that facilitating athletes’ return to high demand
activities, such as pivoting sports, by addressing psychological barriers may increase
the risk of new ACL injury. To some extent, a degree of anxiety may be protective if
it means that athletes do not recklessly resume sports participation without undue
consideration for the health and function of their knee.

During the transition back to sport, athletes typically lack the support of a
rehabilitation professional, having already completed and been discharged from
rehabilitation months before. Therefore, this period might be considered critical for
the likelihood of successfully transitioning back to the previous level of sport. While
top athletes may have the resources to access psychological support during recovery
and rehabilitation, this type of support is not easily accessible for amateur athletes.
Hence, there is a need to develop easily accessible programs to address potentially
modifiable psychological factors that could conceivably impact on returning to sport.
Outcome measures

Evaluating aspects of cognitions, emotions and behaviour during sports injury rehabilitation has been the focus of previous sports injury psychological research, and a wide range of outcomes have been used to evaluate aspects including coping, emotions, mood, locus of control, and adherence to rehabilitation. There has been less focus on the return to sport phase, although increasing research interest has seen the recent development of scales that specifically focus on measuring psychological factors during the return to sport. The Injury Psychological Readiness to Return to Sport scale, Return to Sport after Serious Injury Questionnaire, and Re-Injury Anxiety Inventory all focus on evaluating an athlete’s confidence and concerns with regard to their return to competition after athletic injury.

Two scales, which specifically focus on psychological factors and returning to sport after ACL injury and reconstruction, have evidence of good validity. The ACL-Return to Sport after Injury (ACL-RSI) scale was developed to evaluate psychological readiness to return to sport after surgery. This 12-item scale addresses emotions, risk appraisal and confidence in relation to returning to sport, and has been translated from English to Swedish, French, and German languages. The Knee Self-Efficacy scale (K-SES) was developed to prospectively evaluate an individual’s perception of their ability to participate in physical activity as before their ACL injury. This 22-item scale assesses activities of daily living, sport and recreational activities, physical activities, and perceptions of knee function in the future.

Among a range of sport-specific psychological measures, the ACL-RSI score, measured before surgery and at 4 months after surgery, was found to be the best predictor of returning to the pre-injury level sport at 1 year after ACL surgery.
A recent study of Swedish recreational and competitive athletes found that psychological readiness to return to sport, measured with the ACL-RSI, was the psychological factor most strongly related to returning to the pre-injury physical activity. Two studies have also reported ACL-RSI cut-off scores that discriminated between athletes who subsequently did and did not return to their pre-injury level sport after surgery. One study found a score of 51 points at 6 months after ACL reconstruction (sensitivity 74%, specificity 88%) discriminated returners and non-returners to sport at 7 months, while in the other study, a score of 56 points at 4 months after surgery (sensitivity 58%, specificity 83%) was discriminative of returning to sport at 1 year. Therefore, it may be possible that ACL-RSI scores could be used to identify athletes who may be at risk of not returning to their pre-injury level sport after ACL reconstruction.

Pre-operative K-SES scores were found to predict returning to the pre-injury intensity and frequency of physical activity at 1 year following ACL reconstruction. Further, K-SES scores also predicted muscle function and symptoms at 1 year after surgery. Our research group has also found that self-efficacy (measured with the K-SES) was the psychological factor with the strongest association to satisfaction at 2 to 5 years after ACL reconstruction (unpublished data). Self-efficacy has been shown to improve with time during rehabilitation; men, those who were physically active at a higher level before ACL injury, and those aged under 30 years reported higher pre-operative self-efficacy compared to women, people who were active at a lower intensity and people aged 30 years and over.
Conclusions

Recovery from ACL injury and reconstruction is influenced by a multitude of physical and non-physical factors. This review has demonstrated that psychological factors influence the likelihood of injury, and the prognosis for recovery and returning to sport following surgery. Therefore, the impact of psychological factors should not be underestimated. The results of recent meta-analyses demonstrate moderate to large effects for positive psychological factors favouring returning to the pre-injury level following surgery. Therefore, there is a rationale for the re-evaluation of post-operative rehabilitation programs to include interventions that systematically address psychological factors, with the hypothesis that addressing these factors may improve the return to sport after surgery.

Figure legend

Figure 1. Adapted biopsychosocial model of return to sport after injury

References


