

Review Article

Fear of re-injury following ACL reconstruction: an overview

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Abstract

Patients undergo ACL reconstruction not only to avoid subsequent meniscal or chondral injuries and early osteoarthritis, but especially to return to the pre-injury level of activity. Yet, this level of activity is achieved in only 40 to 70% of the cases. This inability to return to the pre-injury level of activity, even when functional tests allow medical clearance to continue sports, is mainly attributed to fear of re-injury or kinesiophobia. This fear affects the athlete's physical abilities, function and return to sports. Thus, it should be considered as a real risk factor undermining the patients' knee movement and should be one of the core targets for the rehabilitation programme. Healthcare professionals have to assess the athletes that present with fear of re-injury and implement into their rehabilitation programme the appropriate adjunctive interventions, such as the "graded exposure".

Keywords: ACL reconstruction, Kinesiophobia, Sports injuries, Rehabilitation, Return to sports

Introduction

The anterior cruciate ligament (ACL) tear (Figure 1) is a common sports injury in both males and females¹, particularly in sports that require cutting, jumping, or pivoting², with more than 200.000 incidents every year in the United States¹. Likewise, ACL reconstruction is a common operation (Figure 2), both in the USA and in Europe, with more than 100.000 syndesmoplasties being performed every year in the United States and 3.500 per year in Sweden^{1,3}.

A patient with an ACL tear who is treated conservatively, with early activity modification and a neuromuscular rehabilitation programme, may be able in a few days or a couple of weeks to have a painless knee with no oedema. Later, he may also be able to return to sports (RTS), in some extend, by executing simple sports activities that do not include cutting, jumping, or pivoting movements. This way the patients may avoid the stress of the operation, however, as studies have shown, 2/3 of those patients do not return to their pre-injury activity level^{4,5}.

When the patient decides to undergo surgical reconstruction of the ACL tear, he complies with the stress of the operation and the long post-operative rehabilitation programme, ranging from 6 to 12 months. Patients undergo surgery not only to avoid subsequent meniscal or chondral injuries and early osteoarthritis, but

especially to return to their pre-injury level of activity⁶⁻⁹.

According to the current literature, only 40 to 70% of the cases achieve return to the pre-injury activity level following ACL reconstruction¹⁰⁻¹⁵. A recent meta-analysis, which included 48 studies with a mean follow-up of 41 months, revealed that although 90% of the patients achieved normal or nearly-normal knee function, only 63% returned to their pre-injury level of participation. Thus, 1 out of 4 patients achieves complete restoration of the knee joint function, but does not return to the pre-injury level of activity. This disparity between physical function and the ability to RTS is attributed to psychosocial factors^{7,16}. The psychosocial factors that may affect RTS include fear of re-injury (19%), fear of job-loss due to re-injury (11%) and a change in lifestyle or family commitments (18%), when only 13% of

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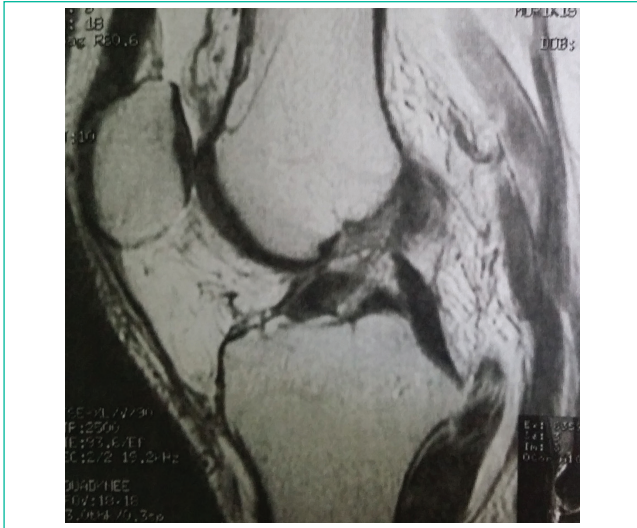


Figure 1. Acute anterior cruciate ligament tear on an MRI.

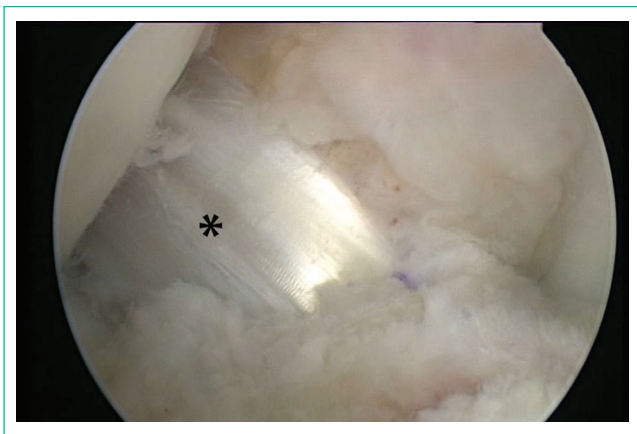


Figure 2. Arthroscopic view of an anterior cruciate ligament reconstruction with a quadrupled hamstrings autograft.

the athletes that failed to return to the pre-injury level of activity were experiencing poor knee function¹⁶.

Purpose of this review article is to provide an overview of the definition, incidence, etiology, assessment and management of fear of re-injury following ACL reconstruction.

Fear of re-injury

The fear of re-injury or kinesiophobia, as it is termed in the literature, is defined as “an excessive, irrational, and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or re-injury”¹⁷. This affects the effectiveness of the rehabilitation

programmes, regardless of the stability of the knee or the lower limb’s strength¹⁸.

High-profile professional athletes have struggled to physically and psychologically RTS after major knee injuries and surgeries, with their performance and career being affected by this psychopathological profile. There is a consistent relationship between the self-confidence of the patient, his optimism and motivation to recover from the injury and the actual outcome of the operation^{12,19}. Fear of re-injury might be more prominent in competitive athletes, as they take part in more aggressive and unsafe scenarios, during both training and professional games, predisposing them to injuries¹⁵.

Fear of re-injury and RTS following ACL-Reconstruction

In the literature, it has been shown that there is a correlation between the existence of this entity and a decreased level of activity following ACL reconstruction (Table 1)^{10,13}. In the study of Tripp et al., fear of re-injury was the only significant factor that was able to even predict the patients’ likelihood of RTS. A high re-injury fear indicated a low chance of returning to pre-injury sports activity level. Interestingly, this finding applied even to patients with little to no pain¹⁰.

Kvist et al. reported 47% of their patients not to be returning to sports-activities after ACL reconstruction. For a quarter of them (24%) the primary reason was kinesiophobia¹³. In another study, half of the patients (52%) who did not return to their pre-injury sport or recreational activity either did not trust their own knee or feared sustaining a re-injury incident, while only 22% failed to return due to poor knee function²⁰.

In the study of Flanigan et al., kinesiophobia was the most common factor related to the inability to RTS. Namely, suffering from fear of re-injury was stated by more than half of the patients (52%) that did not return to their pre-injury level of activity, from both sexes (51% women, 53% men). Furthermore, patients who suffered from persistent knee symptoms reported at the same time that they were experiencing fear of re-injury¹².

According to Filbay et al. fear of re-injury was present to all patients that either did not RTS or returned to a lower level of activity. Some of those patients avoided complex activities, but they still had an active lifestyle (fear accommodation model), while others abandoned sports completely, adopting an inactive lifestyle (fear avoidance model). Finally, patients who suppressed their fear and participated at their previous high level activities (fear suppression model) when a re-injury of the knee occurred or the knee gradually presented symptoms, then they inevitably fell into one of the two previously mentioned categories¹¹.

In another study, out of the 17 patients who did not return to the pre-injury level of sports activities, 9 (53%) declared that the reason was fear of re-injury. Interestingly, these 9 patients had higher patient reported outcome scores (PROs) than the remaining 8 (47%) patients who did not RTS because of persistent knee instability and pain¹⁴. This

Authors	RTS failure	Fear of re-injury incidence	Comments
Kvist et al. 2005 ¹³	47%	24%	All the patients who did not return to their pre-injury activity level experienced higher fear of re-injury than the ones who did.
Ardern et al. 2014 ²⁰	60%	24%	Another 28%, of those who failed to RTS, did not trust their own knee.
Flanigan et al. 2013 ¹²	54% did not return to their pre-injury level of activity	52%	
Filbay et al. 2016 ¹¹	17.6%	100%	Another 29.4% abandoned competitive sports and 17.6% lowered their activity. All these patients experienced fear ranging from "mild" to "severe".
Lee et al 2008 ¹⁴	37.8% did not return to their pre-injury level of activity	53%	
Notarnicola et al. 2016 ¹⁵	52.5%	Not mentioned	No difference in PROs between patients who achieved RTS and those who did not. The decline in sporting level of many patients who succeeded to RTS was mainly attributed to fear of movement and re-injury.

Table 1. Incidence of fear of re-injury in patients who did not achieve to RTS (return to sports) or lowered their activity level following ACL reconstruction in the literature (PROs: Patient Reported Outcome scores).

finding highlights the importance of this psychological entity to athletes whose operation had a successful outcome.

Notarnicola et al. reported that 52.5% of their patients did not RTS, while there was no difference in the PROs between patients who achieved return and those who did not. Moreover, the pre-injury level of activity was restored only in a low percentage of patients, whereas most of them chose a less competitive sport¹⁵. The authors attributed this decline in sporting level mainly to fear of movement and re-injury¹⁵.

Etiology of fear of re-injury

Many athletes who sustain a serious sports injury perceive the way of returning to the pre-injury level of activity as a long and steep one, a terrifying ordeal. Regardless of the efforts of the attending medical and training staff who have performed the necessary clinical, isokinetic and functional tests on the playing field and they have cleared the athletes for sports activities, some athletes still find it difficult to fully perform because of this debilitating fear of re-injury^{7,12,19}. Thereby, many athletes feel that since they are not back confident and in a good frame of mind, then something must be wrong with the health of their knee. They are suspecting that something has gone wrong at their operation, based on the fact that they cannot perform while others who underwent the same operation are doing excellent. Hence a vicious cycle is formed¹⁹.

If we follow this pathway from the incident of the injury

onwards, we find that pain comes firstly, followed by physical and functional impairments, ending with the injury's and surgery's psychological impact. Athletes may suffer from various feelings such as anxiety, stress, confusion, frustration – anger, shame – guilt and even decreased self-esteem and depression²¹⁻²³. These feelings usually accumulate, when medical doctors suggest contradicting opinions regarding the treatment of their ACL injury, ranging from operative to non-operative²⁴. Thus, all these emotions can result in an exaggerated negative psychological response to the knee-pain. Psychological interventions, such as goal setting, relaxation and mental imagery, and positive self-talk, have been suggested to help postoperative patients cope²².

The anticipation of pain during movement along with the aforementioned negative emotions can cause avoidance of movement, the belief that activity may be harmful, fear of the rehabilitation process, as well as preoccupation with symptoms, which all can be summed as the irrational thoughts of pain. This way, patients become extremely fearful of re-injury or specific activities that have been associated in their mind with pain or re-injury risk. A model that is known as the "fear – avoidance model"²⁵⁻²⁸.

It has been proposed, that an increased period between the time of injury and the time of the operation may be negatively associated with the patients' fear of re-injury and confidence, hence, also, affecting the RTS¹⁰. Catastrophizing, another psychological factor that seems to negatively affect successful RTS¹⁰, has been previously associated with pain-related fear in a significant manner^{29,30}.

Consequences of fear of re-injury

Patients experiencing fear of re-injury present with an active avoidance of movement regarding specific activities. They act assuming that activity may harm their knee and thus they fear the rehabilitation programme. They are preoccupied with symptoms and, overall, they express a profile of pain-related fear^{25,28}.

This syndrome affects the athlete's physical abilities, function and their RTS³¹. The most affected physical qualities are the endurance and activation of the muscles that are atrophic due to both the injury and the operation. Furthermore, the recruitment of all the units of the muscle and the range of motion (ROM) of the knee are affected too. Finally, this syndrome may affect the dynamic stability of the knee, along with the neuromuscular co-ordination³¹⁻³⁴.

This psychological entity does not affect the function of the patients in the early stages of the rehabilitation programme. However, when the patient has advanced in more complex exercises, during the late rehabilitation phase, and he is approaching RTS, fear of re-injury has a significant effect on self-report function^{13,18,31,35-37}. The patients are avoiding performing parts of the needed rehabilitation exercises due to fear, aiming to a reduced exposure to physical activities in which they can potentially re-injure themselves, which then is perceived by the athletes as physical impairment^{9,18,31}. This way, the syndrome is born. Hartigan et al. working with 111 patients from 2 clinical trial databases, found a significant negative correlation between fear of re-injury scores (Tampa Scale for Kinesiophobia) and functional scales (KOS-ADL). Namely, they reported that a decrease in the fear of re-injury level was associated with a better knee function from pre- to post-operatively and especially in the period of 6-12 months after surgery³⁶.

Fear of re-injury may delay or even inhibit the athlete's RTS^{10-12,14,16,19,31}. Furthermore, if the athlete succeeds in RTS this fear may result in attention distractions affecting his athletic performance^{31,38,39}. Regarding the sport in which the athlete has injured the knee, fear of re-injury might act as a distinct psychological obstacle impeding the athlete's return to this particular sport¹⁰.

There has also been presented an association between osteoarthritis that may follow an ACL reconstruction and the consequent fear of re-injury, with the low knee confidence leading to worse symptoms⁹.

Management of fear of re-injury

Fear of re-injury during rehabilitation following ACL reconstruction negatively affects the knee function, in both professional and recreational athletes^{10,34,40,41}. Thus, one of the core targets for the rehabilitation programme should be to tackle the fear of re-injury³¹. Addressing the patients' psychological factors, namely the fear of re-injury and their overall confidence, could help those patients return to their pre-injury level of activity²⁰. To achieve this, health

professionals initially should identify the athletes that present with this syndrome. Afterwards, they may be able to implement into the rehabilitation programme the appropriate adjunctive interventions-treatment for the athletes with high fear of re-injury^{16,31,38}.

Fear of re-injury – methods of assessment

The health care professional may ask whether the athletes do fear re-injury and to describe their fears about re-injury and/or RTS (subjective interview)^{12,20,31,39}. There is also a more systematic approach using a self-report questionnaire in an effort to quantify the amount of fear of re-injury^{20,31}. Furthermore, neurocognitive assessment (electroencephalogram – EEG, functional magnetic resonance imaging – fMRI) can be used as an objective approach to evaluate the psychological state of patients. However, it is not easy to perform neurocognitive assessment in the clinical setting and it is mainly used in research studies^{31,42}.

There are a few types of questionnaires that are in use today. These include the “Emotional Responses of Athletes to Injury Questionnaire” (ERAIQ), the “Return to Sport After Serious Injury Questionnaire” (RSSIQ), the “ACL-Quality of Life” (ACL-QoL), the “ACL-Return to Sport after Injury” (ACL-RSI) and the “Tampa Scale for Kinesiophobia” (TSK). The latter two are the ones that are mostly used, with the ACL-RSI questionnaire being more specified to the ACL and the accompanying fear regarding the knee-injury and the RTS. The TSK questionnaire offers a wider approach concerning the psychosynthesis of the patient with regard to pain and activity^{26,31,39,43-45}.

The assessment of the re-injury fear should take place at the beginning of the rehabilitation period which may provide the healthcare professionals with an insight into the athlete's baseline fear of re-injury levels. Also, a second assessment should be performed when the athlete begins the stages of the rehabilitation programme which are compiled with advanced exercise or as part of the battery of tests required for RTS clearance^{25,31}. According to Hartigan et al., fear of re-injury maintains a high level at 6 months and is reaching a plateau between 6 and 12 months postoperatively, when athletes are typically cleared to RTS. Thus, they proposed that the levels of this fear should be monitored from the time of ACL injury up to 12 months after surgery³⁶.

Interventions for athletes with fear of re-injury

Healthcare professionals should intervene in the rehabilitation programme aiming to reduce the “pain-related fear” and to “gradely expose” those patients^{31,46,47}. Psychosocial cognitive behavioural interventions can be of help, improving the patients' coping skills and reducing their re-injury anxiety^{31,38}. A reduction of the pain-related “fear-avoidance phenomenon” can promote both increased participation in activities and the accomplishment of

the rehabilitation tasks and goals that are set for each patient^{25,49}. The proposed “graded exposure” is based on the same foundation as the progressive nature of sports injury rehabilitation following ACL reconstruction, where there is an increase in difficulty of the exercises in the course of time. The “graded exposure” is a technique that was first used with patients that experienced kinesiophobia after low-back pain^{31,46,50,51}.

The general approach of an increasing-difficulty rehabilitation programme following an ACL surgery includes three phases. Phase I, corresponds to the protection phase, Phase II, also known as the restoration phase, and finally Phase III, when the athletes get prepared to return to activities and sports. This intensification of the rehabilitation programme is based on the continuity of the soft tissue healing, the healing of the graft is altered in due time, thus allowing the rehabilitation protocol to take a steeper course, with more advanced exercises⁵². Hence, when working with a patient it is important to progressively expose him/her to situations or activities that cause him/her fear and let him/her realize that these can be completed without inducing any harm. This is mediated by exercise prescription for exposure based on increasing fear or anxiety activities, and not on increasing difficulty. In order for the rehabilitation exercise to become a graded exposure intervention it is required to ascertain the activities that cause fear of re-injury and to develop a hierarchy that increases exposure to the feared activities. Many athletes indeed RTS and may be willing to do certain high-level activities but avoid some other specific movements which they fear might cause them a re-injury. The “graded exposure” aims to prevent this phenomenon^{31,46}. There have been already proposed rehabilitation programmes following ACL reconstruction set in the right direction, such as the one used by the US Military Academy. There, except from the four basic factors; strength, aerobic fitness, coordination, and confidence, RTS is prohibited not only until the patients carry out their prescribed exercises without any problems, but also until they succeed in performing in competition with no fear of re-injury⁵².

Restoring the knee stability has a beneficial effect on the fear of re-injury with the athletes experiencing low dynamic stability being the ones that benefit in a greater degree³⁶. Flanigan et al. compared the patient groups who did with the ones who did not experience fear of re-injury and found no difference with regard to the persistence of knee symptoms. Namely, while 66% (25 of the 38) of the ones with kinesiophobia continued to have problems with their knee, so did 71% (25 out of the 35) of the patients who did not experience fear of re-injury³⁶. Notarnicola et al. reported similar results by having found no difference regarding the clinical scales between patients who RTS and patients who did not, attributing the second's group decline to fear of re-injury¹⁵. Another study characteristically presented patients with higher PROs failing to RTS due to fear of re-injury, when athletes with lower scores but no fear succeeded in

returning¹⁴. Therefore, lowering the re-injury fear might be the factor that effectively helps the patients whose inability to RTS seems illogical. Lowering the re-injury fear seems to have a positive effect on the knee function and pain³⁵.

Preoperative programmes that include neuromuscular training, have been shown to have a positive effect on patients by reducing the level of their fear of re-injury after surgery³⁶. Chmielewski et al. have proposed imagery and cognitive-behavioral methods as possible means to battle fear of re-injury or movement and self-efficacy³⁵. McArdle et al. used cognitive-behavioural methods (disputing, systematic desensitization, and time projection), at the early postoperatively rehabilitation phase, to an athlete who underwent both an ACL and medial collateral ligament reconstruction and they reported a decrease of fear of re-injury⁵³.

Conclusion

There is sufficient evidence to support that fear of re-injury negatively affects the RTS following an ACL reconstruction, even though functional tests allow medical clearance to continue sports activities. According to the literature review 24-100% of the patients who did not RTS or decreased the level of activity following ACL reconstruction suffered from fear of re-injury. Apart from the strict medical assessment and musculoskeletal interventions in the rehabilitation process, the psychological aspect of the athlete after the injury and operation should be considered. Thus, healthcare professionals should be able to recognize athletes with fear of re-injury and adapt their rehabilitation programme to incorporate the appropriate interventions to address this fear, leading to the optimal rehabilitation outcome. Including the evaluation of the athlete's progress with regard to his fear of re-injury in the battery of tests for RTS clearance may contribute to a higher success rate of RTS in the pre-injury level.

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