Development of a fear-avoidance questionnaire for athletes

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Abstract

The fear-avoidance model (FAM) was developed in an attempt to explain the process by which the “pain experience” and “pain behaviour” becomes dissociated from the actual “pain sensation” in individuals who manifest the phenomenon of exaggerated pain perception. High levels of fear-avoidance can lead to chronic pain and disability. Existing fear-avoidance questionnaires have all been developed for the general population. These questionnaires may not be specific enough to fully assess fear-avoidance in an athletic population which copes with pain differently than the general population. The aim of our study was to develop the Athletic Fear Avoidance Questionnaire (AFAQ) and validate it.

A total of 9 experts in the fields of athletic therapy, sport psychology and fear-avoidance were used to generate and rate items for the AFAQ. The final version of the questionnaire includes 10 items who reached statistical significance ($p<0.05$) to establish good internal validity.

Ninety-nine varsity athletes filled out the AFAQ along with the Fear Avoidance Beliefs Questionnaire (FABQ) and the Pain Catastrophising Scale (PCS). Concurrent validity was established with significant correlations between the AFAQ and the FABQ-PA ($r= 0.352$, $p = 0.000$) as well as with the PCS ($r = 0.587$, $p = 0.000$). High internal consistency of our questionnaire was established with a Cronbach’s Alpha coefficient of 0.805.

Therefore, our results indicate that we developed a questionnaire with good internal and external validity. The AFAQ is a scale that measures sports injury-related fear-avoidance in athletes and could be used to identify potential negative psychological barrier to rehabilitation.

Table of Contents

Development of a fear-avoidance scale for athletes

Introduction

The fear- avoidance model (FAM) is based on the emotional reaction component of pain perception and how high levels of fear-avoidance can lead to dysfunction[2]. The model was developed in an attempt to explain why and how some acute pain patients end up developing chronic pain while others do not. The model is comprised of four components: fear of pain, kinesiphobia, fear-avoidance, and catastrophizing. According to the FAM, exaggerated pain perception could lead to the development of chronic pain[2]. Fear of pain is a main focus in the FAM. There are two possible coping reactions to fear of pain; confrontation or avoidance. Individuals who experience elevated levels of fear of pain with signs of fear-avoidance in response to their acute pain will be more likely to develop chronic pain than individuals who confront their fear of pain [2]. In fact, levels of fear-avoidance can be used to assess whether patients with low back pain will be likely to develop chronic pain and to help predict the time of rehabilitation[3, 4].

The fear- avoidance model assessment tools were all developed for the general population or patients with chronic low back pain. The main questionnaires used to assess the four components of the FAM are: the Fear of Pain questionnaire-III (FPQIII), Pain Catastrophizing Scale (PCS), Tempa Scale for Kinesophobia (TSK) and the Fear-Avoidance Beliefs questionnaire (FABQ). The FABQ was developed in part for workers compensation purposes [5]. Injured varsity athletes may not relate to some very work-specific items on the FABQ such as " My pain was caused by my work or by an accident at work". Although some of the questionnaires, such as the PCS, have been validated on athletes, they were not developed specifically for the athletic population[6]. While the PCS was found to be valid for athletic population, the difference in pain ratings between athletes and non-athletes could not be significantly correlated to catastrophizing [6]. These results indicate that the fear-avoidance questionnaires may not be specific enough to athletes in order to fully comprehend fear-avoidance among the athletic population explicitly.

Athletes tend to cope with pain differently and have a higher pain tolerance than the general population [6-10]. In fact, taking part in a sport competition can alter pain perception and increase pain thresholds[8]. Pain is a big aspect of sport and the "no pain, no gain" mentality is very present among athletes. Because of the generalized notion that athletes react to pain differently than the general population, the Sports Inventory for Pain (SIP) was developed specifically to identify beneficial and detrimental pain coping strategies among the athletic population [11]. In fact, the emotional response of athletes to injury can have a big impact on return to play. The more serious the injury, the more mood disturbances the athlete experiences[9]. Fear of reinjury can even prevent people from returning to their sport[12]. In a study by Kvist et al, 24% of participants who underwent ACL reconstruction reported not returning to their sport due to their fear of reinjury [12].

To date, no questionnaire has been specifically developed to assess the fear-avoidance of athletes who differ from the general population in their mentality and reality. Athletes' pain perception differs from the general population however fear-avoidance questionnaires were developed based on the general population. Furthermore, athletes are exposed to pain and sports injuries relatively often, which makes knowing whether fear -avoidance is a major concern amongst that population an important matter. Taking fear-avoidance into consideration might be of importance in order to establish the proper and most effective rehabilitation plan and consequently reduce the time for return to play. A questionnaire specific to athletes might help better establish how the FAM affects the athletic population.

Therefore the aims of our study were 1) to develop the Athletic Fear Avoidance Questionnaire (AFAQ). 2) Validate the AFAQ

Review of literature

The Fear-Avoidance Model

The fear-avoidance model (FAM) was developed by Lethem et al in 1983 in an attempt to explain the process by which the "pain experience" and "pain behaviour" becomes dissociated from the actual "pain sensation" in individuals who manifest the phenomenon of exaggerated pain perception[2]. The authors were trying to explain why some acute pain patients end up developing chronic pain while others do not. The model was developed by emphasizing the important impact the emotional component of pain can have. The cycle starts when sensory and emotional components of the pain perception are desynchronous. The central component of the model is fear of pain[2]. Individuals can either confront or avoid their fear. Avoiding the fear leads to increased disability and eventually chronic pain[2-4].

In 1995, Vlaeyen et al expended the FAM [13] . The expanded FAM includes several psychological components: fear of pain, catastrophizing, fear of movement/(re)injury, and avoidance behaviour [13]. The updated model states that when a person encounters a painful situation due to the injury, their reaction to the painful experience will determine if they will develop chronic pain. Patients who catastrophize enter a maladaptive loop. Catastrophizing leads to fear of movement/reinjury which then leads to avoidance behaviour [14]. The fear of reinjury leads patients to avoid their daily activities in anticipation of pain rather than due to an actual painful stimuli. If the avoidance behaviour is not addressed and becomes lasting, the patients will experience musculoskeletal and cardiovascular detriments which can result in disuse syndrome[14]. Disuse syndrome will increase the disability and pain. Patients who do not catastrophize will confront their pain and enter the recovery loop.

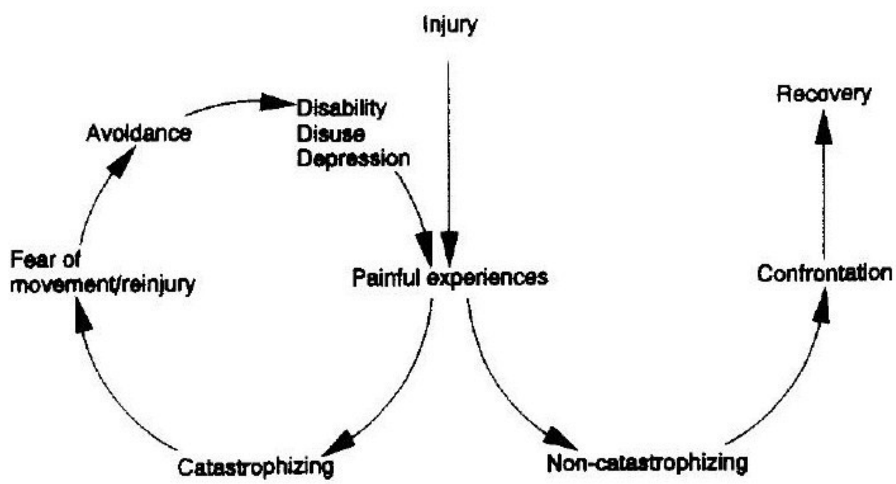

Figure 1
[13]

FAM questionnaires

There are four questionnaires used to assess the four components of the FAM: the Pain Catastrophizing Scale (PCS), the Tampa Scale for Kinesiophobia (TSK), Fear of pain questionnaire-III (FPQ-III) and the Fear-Avoidance Beliefs Questionnaire (FABQ).

The PCS was developed by Sullivan et al to assess levels of catastrophizing [1]. Catastrophizing is commonly defined as an exaggerated negative orientation toward noxious stimuli[1]. As previously mentioned, catastrophizing leads to fear of pain according to the FAM. The 13 items on the PCS are divided into three subscales; rumination (4 items), magnification (3 items) and helplessness (6 items). Each item is rated using a 5-point scale from 0 ("not at all") to

5 ("all the time"). Rumination items describe worry and pain thoughts such as "I anxiously wait for the pain to go away". Magnification refers to the exaggeration of the unpleasantness of pain situations such as "I wonder whether something serious may happen". Helplessness items describe feelings of inability to deal with painful situations such as "I feel I can't stand it anymore". The questionnaire was developed for both the clinical and non-clinical populations. The PCS was found to be valid and reliable [1]. Even though the PCS was not developed for athletes, it is also reliable among that population[6].

The TSK is a questionnaire developed by Kori et al that measures levels of kinesiophobia[15]. Kinesiophobia is the fear of reinjury due to movement [14]. The TSK is a 17-item questionnaire with a four point Likert scale ranging from 1(strongly disagree) to 4 (strongly agree). The items include statement such as "If I were to try to overcome it, my pain would increase" or "It's really not really safe for a person with a condition like mine to be physically active." The TSK is both valid and reliable[13-15]. Regression analysis showed that the TSK is a predictor of disability[13]. The TSK was developed for the general population with chronic pain[15].

The FPQ-III is a questionnaire that measures the fear of pain[16]. There are 30 items evoking painful situations divided into 3 subscales; severe pain, minor pain and medical pain. Each item is rated based the amount of fear evoked on a 5-point Likert scale ranging from 1("not at all") to 5 ("extreme"). The 3 subscales contain items such as "being in a car accident" (severe pain), "getting a paper-cut on your finger" (minor pain) or "receiving an injection in your hip/buttocks" (medical pain). The FPQ was developed using psychology university students [16]. However, only the severe pain subscale items of the FPQ-III can effectively differentiate between patients with chronic pain and the general student population [16]. Overall, the FPQ-III was found to be valid and reliable [16, 17].

The FABQ is a questionnaire developed by Waddell et al and assesses a patient's beliefs on how work and physical activity affects his/her low back pain [5]. There are two subscales; fear-avoidance beliefs on physical activity (FABQ-PA) and fear-avoidance beliefs on work (FABQ-W). The FABQ has a total of 16 items rated on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree." The items refer to how the patient believes the low back pain impacts the daily activities such as "physical activity might harm my back" for the FABQ-PA and "I should not do my normal work with my present pain" for the FABQ-W. The FABQ was found to be reliable and valid[5]. The fear-avoidance beliefs of work are strongly correlated with disability in daily living and work lost[5] whereas the FABQ-PA is stronger at predicting physical performance[18]. The FABQ was developed for workers with low back pain.

None of the questionnaires to assess fear-avoidance were developed specifically for athletes. The wording used or the feelings evoked in all the items of the questionnaires may not be relatable to athletes and their reality. Furthermore, the FABQ was developed for workers with low back pain which greatly differs from a sports injury in nature, context, and impact it has on the injured person. The words used to assess fear-avoidance beliefs due to chronic low back pain and the ones used to assess fear-avoidance beliefs due to a sport injury vary greatly.

Predicted outcomes

Studies have indicated that the FAM questionnaires can be used for predicted outcomes [3, 4]. Klenerman et al conducted a study to determine whether chronic pain could be predicted from an acute low back pain (LBP) in the general population[3]. The participants of the study included 300 acute LBP patients. Questionnaires to assess stressful life events, personality, previous pain history, coping strategies, measures of depression, disability, inappropriate signs and symptoms and pain drawing were filled out by the participants at baseline, 2 months and 12 months. Results indicated that patients with acute LBP will either improve within 2 months or will develop chronic pain [3]. The FAM appears to be the best predictor of the course of LBP within the first two months [3]. Therefore, according to Klenerman et al, the assessment of fear of pain should occur early in the course of acute LBP rehabilitation in order to address the avoidance behaviour if need be [3] .

In another study, Fritz et al aimed to identify psychosocial factors that could predict return to work in patients with acute work-related back pain [4]. Seventy-eight acute LBP patients took part in the study. All participants answered questionnaires on impairment, disability, pain intensity, depression, anxiety, fear-avoidance beliefs and work status at baseline and 4-week follow up. The results revealed that the FABQ-W was the strongest predictor of work status and may be used to predict return to work in patients with acute work-related low back pain [4].

Pain perception and psychological aspects specific to athletes.

There have not been many studies on the impact of fear-avoidance on athletes specifically. Some data emphasize the need to develop a fear-avoidance questionnaire specific to athletes. However, because of the common understanding that athletes deal with pain differently than the general population, there have been some questionnaires developed specifically for athletes [11, 19, 20]. The Sports Inventory for Pain (SIP) was developed by Meyers et al in 1992. The authors wanted to develop a questionnaire to predict the pain response in athletes based on the common knowledge that athletes cope with pain and injury differently than most people [11]. The goal was to develop a sport-specific tool that can identify beneficial and detrimental pain coping strategies. In the first phase of the questionnaire development, Meyers et al asked 20 injured high school and college athletes the following questions: 1. List, as completely as possible, the coping strategies typically used when experiencing injury or surgery-related pain. 2. Describe the intensity, quality, and duration of the pain (i.e. sharp, dull, aching, how long the pain lasts).3. Describe when the pain occurs (i.e. time of day, as a result of what activity) [11]. From the answers gathered in the first phase, the authors developed a 44-item self-report questionnaire with a 5-point Likert scale. In Phase 2, 449 college students filled out the SIP. Statistical analysis reported 5 factors within the questionnaire; coping (COP), cognitive (COG), avoidance (AVD), catastrophizing (CAT) and somatic awareness (SOM) [11]. COP measures the extent to which athletes use direct coping measures ("toughing it out"). COG assesses the use of mental strategies (i.e. imagery) to cope with the pain. AVD measures how much an athlete uses avoidance strategies. CAT detects individuals that dwell on the pain. SOM is a predictor of pain response. The analysis also revealed good internal consistency [11]. A subsequent study by Bourgeois et al tested a shorter 15-item version of the SIP and established good validity and reliability of the questionnaire [20].

The common knowledge, previously mentioned, that athletes have higher pain thresholds than the general population has been confirmed in a few studies[6, 10, 21]. In 2000, Sullivan et al conducted a study on catastrophizing and pain perception in sport participants[6]. Sullivan has already established that people who catastrophize have higher levels of pain and disability than people who do not but wanted to investigate if the same effect applied to athletes[22]. In the first part of the study, the authors established the PCS had a high internal reliability for both the sedentary and athletic population[6]. In the second part of the study, Sullivan et al wanted to examine the PCS scores in predicting pain responses of athletes [6]. Fifty-four varsity athletes and 54 sedentary students took part in the study. Pain was induced by a cold-pressor and the participants verbally rated the evoked pain intensity using a Likert scale. All participants also filled out the PCS. The results showed that athletes reported lower pain intensities than sedentary students which supports the assumption that athletes have higher pain thresholds than the general population [6]. Catastrophizing was also found to be a significant predictor of pain in athletes. However, the difference in pain intensity levels between the two populations could not be explained by the different catastrophizing levels [6].The lack of correlation between the difference in pain intensities and catastrophizing might be due to the fact that the PCS was not developed specifically to assess sport-specific catastrophizing which may affect the scores. Similar results could be observed in a study by Paparizos et al [10]. The authors looked at catastrophizing and pain perception in recreational ballet dancers. The study was conducted under the assumption that ballet dancers encounter pain substantially and that they are in fact a mix of artists and high performance athletes [10]. Forty-seven dancers from Queens dance club (separated into groups according to levels of experience) and 26 psychology undergraduate students took part in the study. The participants filled out 3 questionnaires; the PCS, the Profile of mood state (short form) and the Mcgill Pain questionnaire (short form). Pain was induced by a cold-pressor and the participants rated the evoked pain intensity verbally with a numerical rating scale. The results were that catastrophizing levels between dancers and non-dancers were not significantly different. However, there was a trend that dancers with over 10 years of experience had lower levels of catastrophizing than the dancers with less than 10 years of experience. The dancers with higher skills and experience had significantly higher pain tolerance than others with less skill. Dancers had also a higher pain tolerance than the non-dancers [10].

Although the fact that athletes have higher pain tolerance than the general population is well established, the reasons why remain unclear. Sternberg et al investigated a plausible physiological explanation behind athletes' high pain thresholds [8]. The authors based their study on stress-induced analgesia which is a reduced sensitivity to noxious stimuli by acute stressful events [8]. The aim of the study was to establish whether competing in an athletic event results in a reduction in sensitivity to noxious stimuli. Sixty-seven athletes of NCAA level and 20 non-athletes took part in the study. Among the athletes there were 21 basketball players, 11 fencers and 35 track runners. Pain perception was tested using a cold-pressor test and Gracely box scales to rate the pain evoked. Withdrawal latency was measured using a noxious heat source on the fingers and forearm. Pain attitudes were assessed using a VAS to measure the frequency of pain experience during the sport participation, pain medication use and the nature of the pain experience that comes with being an athlete. Subjective stress ratings were obtained using the Stress Symptoms Rating Scale. Pain thresholds and ratings to noxious cold and subjective stress ratings were taken 2 days before competition and 2 days post-competition as well as right after competition. Results showed that all athletes reported less intense and unpleasant pain from the cold-pressor test following competition whereas the non-athletic results remained the same [8]. Also, basketball and track athletes had higher pain thresholds (in response to heat) on competition day [8]. Athletes reported higher levels of stress and anxiety the day of competition.

Deroche et al looked at psychological coping strategies to explain athletes' ability to "play through the pain" [7]. The authors had two hypotheses before conducting the study; 1. pain coping strategies, including: distraction from pain, praying, reinterpreting pain sensations, ignoring pain, and pain catastrophizing, are linked to healthy athletes' inclination to play through pain and 2. These pain coping strategies can attenuate the negative relationship between pain intensity and athletes' inclination to play through pain [7]. 205 athletes from combat sports (judo, taekwondo, karate, and wrestling) who experienced pain in the previous month took part in the study. The pain intensity was measured using a VAS. The pain behaviour was assessed using a VAS while asking the athletes: ‘‘On average, how much has pain lowered your physical involvement in your sport activity?’’ and “On average, did pain prompt you to modify your training tasks in your sport activity?’’ [7]. The pain coping strategies used by the participants were obtained using the Coping Strategies Questionnaire (French version). The results indicated that the higher the level of catastrophizing, the less inclined the athlete is to play through the pain [7]. Also, the more the athlete ignores the pain, the more he can play through the pain and the more the impact of pain intensity on sport participation is reduced [7]. Anderson et al also focused on psychological factors to explain how athletes, specifically dancers, ignore their pain to keep performing[23]. The authors state that athletes experience two types of pain; routine pain from performance and acute/chronic pain from injury and usually react positively to performance pain but negatively to injury pain [23]. The aim of the study was to look at the relationship between the type of pain experienced (performance or injury), the appraisal of the pain (threatening vs. controllable) and subsequent pain coping behaviours by dancers. Forty-eight professional dancers and 3 university level dancers took part in the study. The participants filled out a general questionnaire about past experiences with pain. They also filled out 3 other questionnaires; the Pain Appraisal inventory (PAI), the Survey of Pain attitudes (SOPA) and the SIP. The results demonstrated that dancers do not differentiate between the experience of performance pain and injury pain and their pain appraisal does not differ between the two types of pain [23]. However, the coping strategy varies with the type of pain the dancers experience. When the type of pain experienced is performance pain dancers tend to use the SIP coping subscale (at low or high pain intensities). When the injury is felt as threatening the coping strategy used was catastrophizing or avoidance [23].

Athletes not only have a specific way of coping with pain but also with injury. Smith et al conducted a study in order to identify the presence, type, magnitude and time course of emotional responses of athletes to injury that might affect the rehabilitation [9]. Seventy-two injured athletes participated in the study. All participants had to respond to two questionnaires; the Emotional Response of Athletes to Injury Questionnaire (ERAIQ) and the Profile of Mood States Short Form (POMS). The athletes filled out the questionnaires when injured and then every two weeks until return to play (up to 4 months). The results showed that at first, athletes rated depression and anger the highest on the ERAIQ. At the 2- week follow up depression anger tension and confusion had subsided whereas vigor increased [9]. Smith et al also noted that the more severe the athlete perceived the injury to be, the more the athlete would experience mood disturbance.

The emotional response of athletes to injury varies according to playing status (amateur vs. professional [24]. Oztekin et al conducted a study with the aim of assessing the effect of player status on pain intensity and affective distress (depression and anxiety) before ACL surgery, and in the early postoperative period. Ten amateur and 20 professional soccer players with an ACL tear participated in the study. The pain intensity was measured using a VAS. Depression and anxiety were assessed using the Beck Depression Inventory (BDI) and Stait-Trait Anxiety Inventory (STAI). All measurements were taken 24 hours before the surgery (T1), one week post-surgery (T2) and 3 weeks post-surgery (T3). The results indicated no significant differences in pain intensities between professional and amateur players [24].The main differences between the amateur and professional players were the depression levels. The professional players had significant higher BDI scores at T1 and T2 than amateur players. The difference in BDI scores was no longer present at T3 [24]. Oztekin et al hypothesized that the higher depression levels in professional athletes may be due to the threat of losing playing opportunities and income [24].

The reaction of athletes to injury can also vary with age[25]. Tripp et al compared postoperative pain experiences of adolescent and adult athletes after ACL surgery. The aim of the study was to examine age-related differences in pain, catastrophizing, and affective distress (depression and anxiety) after athletic injury and consequential knee surgery [25]. 10 adolescent athletes and 10 adult athletes took part in the study. The pain intensity was measured with a VAS. Depression and anxiety was measured with the BDI and STAI (short form). The PCS was used to assess catastrophizing. The results showed that adolescent athletes had significantly higher pain intensities and catastrophizing levels than adult athletes [25]. The authors suggested that the results may be due to the fact that adolescents might have a lack of understanding of their injury and they lack experience with the recovery from an injury and dealing with the threat of loss of competitive status. Another interesting finding was that controlling for catastrophizing eliminated the differences in pain intensities [25].

Kvist et al also reported a study on the psychological impact an injury can have on a player [12]. The aim of the study was to determine whether fear of reinjury is an important factor for returning to previous levels of activity in patients who have had an ACL surgery. The participants were 62 patients aged from 16 to 35 who had ACL surgery 3-4 years prior to the study. Participants filled out 3 questionnaires; TSK, the Knee Injury and Osteoarthritis Outcome Score (KOOS) and a general questionnaire about the injury and previous sport played. The KOOS measures 5 subscales: pain, symptoms, function of daily life, function in sport and knee-related quality of life [12]. Results showed that out of the 47% of the people that did not return to their sport, 24% of them did not return to play due to their fear-of reinjury [12]. People who returned to their preinjury levels of activity had the lowest levels of fear of reinjury whereas people who did not return to their preinjury levels of activity had a higher fear of reinjury and worst knee quality of life [12].

As seen by the previously mentioned studies, psychological factors are important to take into consideration when dealing with athletes. Psychological factors can even predict injury as observed by Shrier et al. [26]. Psychological factors such as stress, coping skills and personality can have an impact on injury risk [26]. The authors looked at psychological predictors of injuries in circus artists. The participants were 47 elite athletes in career transition that were taking part of the training at Cirque du Soleil. All the participants filled out the RESTQ-76 questionnaire and their injury data was obtained with the Cirque du Soleil injury database. The analysis revealed that low self-efficacy, high levels of fatigue, emotional exhaustion and past injury are associated with 2-3 fold increase in the risk for injury. Low-self efficacy being the most strongly correlated [26].

In order to avoid fear-avoidance from delaying athletes in their recovery, addressing the avoidance behavior during their rehabilitation would be of importance. George et al investigated the effect of a fear-avoidance based physical therapy intervention for patients with acute low back pain [27]. The fear-avoidance based treatment proposed by the authors de-emphasizes anatomical findings and rather encourages the patient to take an active role in the recovery process. Patient education is also emphasized so that the patients realize that their condition is not a serious disease but rather a common condition. George et al compared the fear-avoidance-based treatment to traditional treatment. The results showed that patients with higher levels of fear-avoidance benefit from the fear-avoidance based treatment whereas those with lower levels of fear-avoidance do not [27].

Questionnaire Development

In order to develop a questionnaire specific to athletes we used a Delphi Survey method as used by Glazer et al [19]. The Delphi survey method uses expert opinion to help form a survey by responding to questionnaires [28].The authors used the Delphi Survey method when developing the Injury-Psychological Readiness to Return to Sport Scale (I-PRRS). The questionnaire was developed in order to provide a good tool to assess an athlete's confidence and psychological readiness to go back to play [19]. The panel for the I-PRRS development consisted of: 4 Athletic therapists and teachers in AT programs and 3 NCAA coaches (one was teaching psychology at college, one was a former injured athlete, and one had his masters in sports psychology). The first step was to gather the panel and ask their opinions on what items should be included in the questionnaire. Based on the answers, the survey is revised and redistributed to the experts for further feedback. This process continues until a consensus is reached. The panel first submitted 22 items that were then revised and resubmitted to them. After further feedback the 22 items were cut down to 10. 3 rounds of the Delphi method were conducted. The panel was then asked to rate the relevance of the final 10 items on a scale from 1(no match) to 5(excellent match) to obtain a reliability coefficient. Analysis revealed good reliability and external validity. Good concurrent validity was also demonstrated by correlating the I-PRRS to the POMS [19]. Content validity is crucial when developing a questionnaire. Evidence of the content validity is mostly judgemental in nature [29]. Judgemental evidence is usually obtained using a panel of experts with professional expertise in the area of the questionnaire topic[29]. Therefore, the Delphi method seems to meet the criteria needed to establish content validity. The Delphi method has also been used often in the medical field to narrow down items generated by experts when developing assessment tools such as done during the Quality of Reporting of Meta-analyses (QUOROM) conference[30]. During the QUOROM conference, 30 experts were asked to provide items they thought should be included in a list of standards for clinical trials. A Delphi method was used to narrow down the items[30]. As previously mentioned, the development of the SIP was also done by asking individuals specific questions that would generate potential items for the questionnaire [11]. Meyers et al also derived existing items from existing non-sport specific questionnaires [11]. Another technique used to develop assessment tools is the Ebel procedure. The Ebel procedure is used to establish a minimal passing level (MPL) by categorizing checklist items on an assessment tool based on degree of difficulty (easy, moderate, hard) and importance (questionable, acceptable, important, essential), creating a 3x3matrix [31]. Consensus is reached when the majority experts agree that an item belongs in the same category or cell. However, the Ebel procedure is mostly used to create assessment tools to grade specific skills or tasks such as the Standardized Orthopedic Assessment Tool (SOAT) and the Taping Skills Assessment Instrument (TSAI) [32, 33]. Since our questionnaire is not aimed at assessing skills but rather to establish the levels of fear-avoidance in athletes, the Ebel procedure would not have been be appropriate.

Methods

Part 1: Questionnaire development

Participants: Panel members.

Procedure:

For the development of the AFAQ we followed the Delphi survey method as used to develop the Injury- Psychological Readiness to Return to Sport (I-PRRS)Scale [19].

We gathered a panel of experts (5 people). The experts were chosen so that the various aspects of our questionnaire (athletic therapy, athletes, sport psychology and fear-avoidance) would all be considered. The experts consisted of a head athletic therapist from Guelph University with over 30 years experience, the head athletic therapist from Concordia University for the past 7 years, Concordia University's Men's Basketball head coach who has been named coach of the year 13 times in 24 seasons in his conference, McGill university professor and inventor of the PCS which is one aspect of the fear avoidance model, and a mental performance consultant who works with collegiate and national level athletes and used to be an athlete herself as well. Prior to the meeting we had submitted to each panel member information on fear-avoidance and asked them to think of possible items that they would suggest for our scale based on their respective experiences.

The day of the panel meeting, all experts were present in the same room. We started the meeting by having a group discussion on fear-avoidance and how each expert had encountered fear-avoidance throughout their respective experience and line of work. Then panel members were asked to provide outcome-dependent items they consider relevant for an athletic fear-avoidance questionnaire. Members were also asked to provide terminology they encounter when dealing with athletes. Athlete specific terminology is critical to generate a scale that athletes resonate with. We asked the experts to use words or sentences that they hear athletes use regularly when injured in order to reflect their reality in the items of the scale. By using athletic specific terminology regarding fear-avoidance, it increases the chance of generating a valid scale. All items generated by the experts throughout the meeting were gathered. After the meeting, all items were sent to all panel members to provide them an opportunity to revise them and provide comments outside of the group environment. This is an important process since all panel members might not feel comfortable verbalizing any conflicting thoughts in person with people on the panel. After we received the panel's thoughts and comments on all items, we revised them and submitted 30 items as a whole to a total of 8 experts. The experts included four of the five original experts that were at the panel meeting and four new experts were used. The four additional experts included the lab director of the sport psychology research laboratory at McGill University and three other athletic therapists who have had experience with professional or varsity athletes. The experts were asked for further suggestions and consideration. We asked the experts to rate each item in terms or relevance on a scale from 1 (no match) to 5 (excellent match) [10].

After the two rounds of comments and ratings from the experts, 24 items remained. The 6 items removed were eliminated due to consistently poor ratings or if one of the experts provided a good rationale for its exclusion. The ratings of the 24 items from the 8 experts were analyzed to generate a V-coefficient[34]. The V-coefficient or content-validity coefficient is a statistical method developed by Aiken to analyze data from validity judgements or ratings (e.g. experts' ratings)[34]. The V-coefficient can range from 0 to 1, a high value representing that an item has a high content validity [34]. The V-Coefficient is generated by the formula provided by Aiken based on the amount of items, number of judges and rating system used: $V= S/[n(c-1)]$ [34]. The statistical significance ($p<0.05$) of the V-coefficient were obtained by comparing our V-coefficients to the right-tailed binomial probability table provided by Aiken[34]. The probability table provides minimal V-coefficient values needed in order to reach significance, depending on the number of judges and items used. The items that did not meet the required V-coefficient value were eliminated. Therefore, the original 30 items were narrowed down to 11 items based on their respective V-coefficient. One of the 11 items was removed due to the fact that the wording of the item would have required a different rating system. The way the item was phrased "I can't wait to go back to play" would have generated a high value for an individual with low fear-avoidance which would be contrary to the rest of the items. The final questionnaire is comprised of 10 items (see Appendix).

Part 2: Establishing concurrent validity of the AFAQ

Participants: 103 Concordia University Varsity athletes from various sports (soccer, rugby, football, basketball and hockey).

Procedure: the participants were asked to fill out the AFAQ along with the FABQ and PCS (see Appendix) .

Results/Analysis

A sample of 103 Concordia varsity athletes filled out the AFAQ along with the FABQ and PCS. The sample of athletes included male, female, injured and non-injured from various sports. The data of four athletes was eliminated due to items missing. The data from 99 athletes was analyzed. The average score on AFAQ was 23.70 (SD=6.98); the average FABQ-PA score was 12.74 (SD= 5.98); the average FABQ-W score was 9.43 (SD=8.81); the average PCS score was 16.75 (SD=9.44).

Questionnaire	Average Score	SD
AFAQ	23.70 (out of 50)	6.98
FABQ-PA	12.74 (out of 24)	5.98

FABQ-W	9.43 (out of 42)	8.81
PCS	16.75 (out of 52)	9.44

Table 1 - Average questionnaire scores

Pearson Correlations revealed the AFAQ significantly correlated to the PCS (r = 0.587, p = 0.000), FABQ-T (r=0.279, p= 0.005) and FABQ-PA (r= 0.352, p = 0.000). No significant correlations were found between the fear-avoidance questionnaire for athletes and the FABQ-W (r=0.137, p= 0.176.)

Correlations	**r-value**	**p-value**
AFAQ-PCS*	0.587	0.000
AFAQ-FABQ(T)*	0.279	0.005
AFAQ-FABQ(PA)*	0.352	0.000
AFAQ-FABQ(W)	0.137	0.176

Table 2- Comparison between the AFQ and other questionnaires

Using the 99 data points collected from athletes, internal consistency of our questionnaire was established with a Cronbach's Alpha coefficient of 0.805 and each individual item correlated to the total score test (alpha>0.4).

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.805	.804	10

Table 3 - Cronbach's alpha

Inter-Item Correlation Matrix

	FA-Ath9	FA-Ath10b	FA-AthT(b)
FA-Ath1	.182	.180	.606
FA-Ath2	.353	.167	.749
FA-Ath3	.206	-.013	.516
FA-Ath4	.257	.133	.435
FA-Ath5	.230	.185	.677
FA-Ath6	.423	.283	.487
Fa-Ath7	.376	.219	.684
FA-Ath8	.502	.208	.655
FA-Ath9	1.000	.585	.698
FA-Ath10b	.585	1.000	.491
FA-AthT(b)	.698	.491	1.000

Table 4 - Cronbach's alpha: inter-correlation matrix

A factor analysis revealed Eigen Values of over 1 for four items on our scale (1, 2, 5, 7). Factor analysis is used to identify groups of items that share a common underlying dimension that varies from the other items[35]. An Eigen value is an estimate of variance explained by a specific factor and a value of over 1 indicates an above average amount of variance [36]. Factor rotation is used to improve the interpretation by reducing ambiguities associated with unrotated factor solutions and obtain simpler and theoretically more meaningful results[35]. Varimax is an orthogonal rotation technique [35]. The rotated matrix values generated with a Principal Component Analysis and Varimax with Kaiser Normalization revealed that those four items did not all reach values of above 0.7. Therefore, the factor analysis revealed no significant subscales within our scale.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.740	37.401	37.401	3.740	37.401	37.401
2	1.498	14.983	52.384	1.498	14.983	52.384
3	1.080	10.801	63.185	1.080	10.801	63.185
4	1.005	10.053	73.238	1.005	10.053	73.238
5	.697	6.968	80.206			
6	.603	6.026	86.232			
7	.483	4.828	91.059			
8	.335	3.351	94.410			
9	.300	3.001	97.411			
10	.259	2.589	100.000			

Table 5 - Factor analysis

Rotated Component Matrix[a]

	Component			
	1	2	3	4
FA-Ath1	.908	.082	.044	.012
FA-Ath2	.580	.083	.418	.421
FA-Ath3	.248	-.078	.112	.832

FA-Ath4	.050	.008	.843	-.085
FA-Ath5	.885	.093	.083	.156
FA-Ath6	-.030	.589	-.054	.595
Fa-Ath7	.492	.198	.448	.204
FA-Ath8	.161	.289	.711	.228
FA-Ath9	.105	.775	.366	.194
FA-Ath10b	.176	.858	.060	-.180

Table 6 - Factor analysis: rotated matrix

Discussion

The variety of the experts chosen on our panel assured good validity of the items generated due to the fact that all aspects related to our questionnaire; sport psychology, questionnaire development, athletic injuries and athletic experiences were addressed by our experts' respective area of expertise. As previously mentioned, a careful selection of experts that reflect the nature of the scale is a key part of establishing validity for a questionnaire development [37]. The V-Coefficient generated for each item assured the quantifiable and statistically significant validity of each item selected on the final version of the scale. Furthermore, analysis revealed good internal consistency due to a high cronbach's alpha (0.805). The cronbach's alpha provides a value of the extent to which items are related to each other and is a way of establishing good reliability in the form of internal consistency [38, 39]. A value of above 0.7 is considered acceptable [39]. However, a value of above 0.9 would mean items are too redundant[40]. Similarly the PCS, FABQ-W and FABQ-PA had reported cronbach's alphas of 0.87, 0.88 and 0.77 respectively [1, 5]. The inter-item correlation matrix reveals how each item correlates to the total score of the scale. The low coefficient (0.435) of item 4 " I am not sure what my injury is" can be explained due to the setting in which we collected data. All injured athletes at Concordia University are assessed and treated by athletic therapist and are therefore most likely aware of what their injury is. The factor analysis revealed no subscales within our questionnaires. However, the fact that four of our items had eigen values of above one but their values in the rotated matrix were not all above 0.7 suggest that our scale is complex in nature and measures the different aspects of the fear-avoidance model such as fear-avoidance beliefs and catastrophizing thoughts. Therefore, our results for the V-coefficient and cronbach's alpha show that we have developed a complex questionnaire with good internal validity and consistency.

Concurrent validity was established by the significant correlations between our scale and the PCS and FABQ which are existing validated assessment tools of catastrophizing and fear-avoidance beliefs [1, 5]. These results indicate that our scale accurately measures fear-avoidance in athletes. The weaker correlations between our questionnaire and the FABQ-PA ($r= 0.352$, $p = 0.000$) compared to those of with the PCS ($r = 0.587$, $p = 0.000$) can be explained by the two different natures of the scales. The items of the FABQ are worded to address "beliefs" rather than actual emotions related to fear and are therefore one step removed from the actual fear. For example, item 4 of the FABQ-PA states "I should not do physical activities which (might) make my pain worse." Item 4 addresses a belief rather than the actual feeling evoked by the thought of taking part in physical activities. On the other hand, the items on the PCS address the feelings related to the pain more directly in its wording; "it's awful and I feel that it overwhelms me". The fact that the majority of our items were worded to describe the emotions an athlete may be feeling in regards to an injury rather than believes may explain the higher correlation to the PCS compared to the FABQ-PA. The lack of any significant correlations between the FABQ-W and our questionnaire ($r=0.137$, $p= 0.176$.) was expected due to the fact that all the items on the FABQ-W are work related and therefore not relatable for athletes.

Correlating an existing questionnaire to establish concurrent validity was also done in the development of the I-PRRS previously mentioned [19]. The I-PRRS was developed to measure the psychological readiness of injured athletes to return to play [19]. To establish concurrent validity, the subjects also filled out the POMS along with the I-PRRS at four different time intervals. The POMS was chosen to establish concurrent validity because it is a validated scale that measures the amount of mood disturbance experienced which overlaps with the construct being measured by the I-PRRS[19]. Results revealed a significant correlation between the I-PRRS and the POMS at the four different times measured; after injury ($r= -0.62$, $P= 0 .002$), before practice ($r = -0.78$, $P < 0 .001$), before competition ($r = - 0.59$, $P = 0.004$), and after competition ($r= -0.57$, $P= 0 .005$) [19].

The very high correlation between our scale and the PCS could indicate that the two scales measure the same construct. However, it is not unheard of that two highly correlated scales can measure two overlapping and yet different constructs [41, 42]. Anxiety and depression is a good example of two overlapping constructs that are highly correlated and yet can be effectively measured as two separate and specific constructs [41, 42]. Dobson et al have reported an average correlation of 0.61 between depression and anxiety scales including the Beck's depression inventory (BDI) and the State-trait anxiety inventory (STAI) with a correlation of 0.79 ($p<0.0001$)[41]. With such high correlations one might wonder if it is possible to accurately measure depression and anxiety as two different constructs. Beck's cognitive theory (CT) argues that depression and anxiety can be differentiated by their cognitive profiles [43]. In depression, automatic thoughts are dominated by feelings of current loss and failure. In anxiety, thoughts are more future or predictive based and involve feelings of anticipated harm or danger [44]. Along the same principle as the CT, Watson and Tellegen's two dimensional model of affect suggests that there are two main factors that describe mood; positive affect (PA) and negative affect (NA) [45]. According to this model, depression can be described as having high NA and low PA whereas anxiety has only high NA. Therefore, depression can be differentiated from anxiety by its state of anhedonia (low PA) which involves depressed physiology and behavior resulting in loss of pleasure in activities [42]. Anxiety can be differentiated by hyper arousal physiology or anxious arousal[42] . In a 2003 study, results showed that Beck's Depression Inventory (BDI) could accurately measure the anhedonia symptoms of depression and the Beck Anxiety Inventory (BAI) could accurately measure the hyper arousal symptoms of anxiety. The high correlation between the BAI and BDI scales were explained as due to the common high NA that both anxiety and depression exhibit but did not undermine each scales' capacity to accurately measure each construct [42]. Therefore, two scales can be highly correlated without being necessarily redundant.

Similarly to depression and anxiety, the high correlation between our scale and PCS does not necessarily mean that our scale is redundant. All aspects of the fear-avoidance model (fear of pain, catastrophizing, fear-avoidance belief) overlap. However, different scales such as the PCS and FABQ measure different aspects of the model [46]. For example, although both the affective component of fear and catastrophizing deal with threat perception and hypervigilance, only catastrophizing addresses the ability to cope with pain (helplessness) [46]. Furthermore, the FABQ was developed based on the same theoretical background as the Pain and Impairement Relationship Scale (PAIRS) and the Survey of Pain Attitudes (SOPA) but added a work element that was not present in the two other existing scales [5]. Likewise, our questionnaire was developed based on the same theoretical background as the FABQ and PCS but a sport specific aspect which is not present in the PCS nor in the FABQ was added. The AFAQ can therefore be correlated to the PCS or FABQ because it measures similar overlapping principles without undermining the AFAQ's effectiveness in measuring athletic fear-avoidance specifically.

Some limitations of this scale development were that it did not include a pain measure to keep track of whether an athlete being in pain or not would affect the results. Further validation is needed to correlate the AFAQ to return to play time in injured athletes.

Conclusion

The AFAQ is a scale that measures sports injury-related fear-avoidance in athletes. This scale could be used by sports medicine professionals as an extra rehabilitation tools to identify fear-avoidance in athletes as a potential negative psychological barrier to rehabilitation. The scale could also be used by sport psychology consultants and coaches to better assess athletes.

Appendix

Table- 7 Correlations: AFAQ-PCS

		FA-AthT(b)	PCST
FA-AthT(b)	Pearson Correlation	1	.587**
	Sig. (2-tailed)		.000
	N	99	99
PCST	Pearson Correlation	.587**	1
	Sig. (2-tailed)	.000	
	N	99	99

**. Correlation is significant at the 0.01 level (2-tailed).

Table 8- Correlations: AFAQ-FABQ(PA)

		FA-AthT(b)	FABQ-PA
FA-AthT(b)	Pearson Correlation	1	.352**
	Sig. (2-tailed)		.000
	N	99	99
FABQ-PA	Pearson Correlation	.352**	1
	Sig. (2-tailed)	.000	
	N	99	99

**. Correlation is significant at the 0.01 level (2-tailed).

Table 9- Correlations: AFAQ- FABQ(W)

		FA-AthT(b)	FABQ-W
FA-AthT(b)	Pearson Correlation	1	.137
	Sig. (2-tailed)		.176
	N	99	99
FABQ-W	Pearson Correlation	.137	1
	Sig. (2-tailed)	.176	
	N	99	99

UNIVERSITÉ Concordia UNIVERSITY

Name: **Sport:** **Date:**

Athletic Fear Avoidance Questionnaire (AFAQ)

Instructions: We are interested in your feelings or thoughts when in pain as a result of a sport injury. Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are in pain due to a sports injury.

Rating	**1**	**2**	**3**	**4**	**5**
Meaning	Not at all	To a slight degree	To a moderate degree	To a great degree	Completely agree

Statement	**Rating**
1. I will never be able to play as I did before my injury	
2. I am worried about my role with the team changing	
3. I am worried about what other people will think of me if I don't perform at the same level	
4. I am not sure what my injury is.	
5. I believe that my current injury has jeopardized my future athletic abilities	
6. I am not comfortable going back to play until I am 100%	
7. People don't understand how serious my injury is	
8. I don't know if I am ready to play	
9. I worry if I go back to play too soon I will make my injury worse	
10. When my pain is intense, I worry that my injury is a very serious one.	

Figure 2- Athletic Fear-Avoidance Questionnaire

Pain Catastrophizing Scale

Sullivan MJL, Bishop S, Pivik J. (1995)

Name:	Age:	Gender:	Date:
----------------------------	----------	☐Male ☐Female	---------------------

Everyone experiences painful situations at some point in their lives. Such experiences may include headaches, tooth pain, joint or muscle pain. People are often exposed to situations that may cause pain such as illness, injury, dental procedures or surgery.

Instructions:
We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.

RATING	0	1	2	3	4
MEANING	Not at all	To a slight degree	To a moderate degree	To a great degree	All the time

When I'm in pain …

Number	Statement	Rating
1	I worry all the time about whether the pain will end.	
2	I feel I can't go on.	
3	It's terrible and I think it's never going to get any better	
4	It's awful and I feel that it overwhelms me.	
5	I feel I can't stand it anymore	
6	I become afraid that the pain will get worse.	
7	I keep thinking of other painful events	
8	I anxiously want the pain to go away	
9	I can't seem to keep it our of my mind	
10	I keep thinking about how much it hurts.	
11	I keep thinking about how badly I want the pain to stop	
12	There's nothing I can do to reduce the intensity of the pain	
13	I wonder whether something serious may happen.	

Source: Sullivan MJL, Bishop S, Pivik J. The pain catastrophizing scale: development and validation. *Psychol Assess*, 1995, 7: 524-532

Figure 3- Pain Catastrophizing Scale [1]

Fear-Avoidance Beliefs Questionnaire (FABQ)
Waddell et al (1993) Pain , 52 (1993) 157 - 168

Here are some of the things which other patients have told us about their pain. For each statement please circle any number from 0 to 6 to say how much physical activities such as bending, lifting, walking or driving affect or would affect *your* back pain.

	Completely disagree			Unsure			Completely agree
1. My pain was caused by physical activity...................................	0	1	2	3	4	5	6
2. Physical activity makes my pain worse.....................................	0	1	2	3	4	5	6
3. Physical activity might harm my back......................................	0	1	2	3	4	5	6
4. I should not do physical activities which (might) make my pain worse	0	1	2	3	4	5	6
5. I cannot do physical activities which (might) make my pain worse......	0	1	2	3	4	5	6

The following statements are about how your normal work affects or would affect your back pain

	Completely disagree			Unsure			Completely agree
6. My pain was caused by my work or by an accident at work............	0	1	2	3	4	5	6
7. My work aggravated my pain..	0	1	2	3	4	5	6
8. I have a claim for compensation for my pain..............................	0	1	2	3	4	5	6
9. My work is too heavy for me...	0	1	2	3	4	5	6
10. My work makes or would make my pain worse..........................	0	1	2	3	4	5	6
11. My work might harm my back..	0	1	2	3	4	5	6
12. I should not do my normal work with my present pain.................	0	1	2	3	4	5	6
13. I cannot do my normal work with my present pain......................	0	1	2	3	4	5	6
14. I cannot do my normal work till my pain is treated......................	0	1	2	3	4	5	6
15. I do not think that I will be back to my normal work within 3 months.	0	1	2	3	4	5	6
16. I do not think that I will ever be able to go back to that work..........	0	1	2	3	4	5	6

Scoring
Scale 1: fear-avoidance beliefs about work - items 6, 7, 9, 10, 11, 12, 15.
Scale 2: fear-avoidance beliefs about physical activity – items 2, 3, 4, 5.

Source: Gordon Waddell, Mary Newton, Iain Henderson, Douglas Somerville and Chris J. Main. A Fear-Avoidance Beliefs Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. *Pain*, 52 (1993) 157 - 168. 166.

Figure 4- Fear Avoidance Beliefs Questionnaire [5]

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