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# Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology

journal homepage: [www.ap-smart.com](http://www.ap-smart.com)

## Original Article

## Return to sport and knee functional scores after anterior cruciate ligament reconstruction: 2 to 10 years' follow-up

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## ARTICLE INFO

## Article history:

Received 20 September 2017  
 Received in revised form  
 22 January 2018  
 Accepted 22 January 2018  
 Available online xxx

## Keywords:

Anterior cruciate ligament  
 Return to sport  
 ACL outcomes  
 Knee function

## ABSTRACT

**Background:** Anterior cruciate ligament (ACL) reconstruction is one of the most common knee ligament reconstruction sustained by sports players. Previous studies have revealed different rates of returning to play sports depending on study sites, subjects, and time to follow-up; however, this subject has not been adequately investigated in Thailand.

**Objectives:** This study aimed to assess the percentage of ACL reconstruction patients who successfully returned to sport activities. Factors associated with being able to return to sport were also determined.

**Materials and methods:** A cross-sectional study was conducted to assess the rates of return to sport of patients who underwent ACL reconstruction between 2005 and 2015. All potential patients were initially contacted via letter or mobile phone and asked to report their long-term follow-up outcomes. Collected data from the interview, including return to sport status, performance following ACL, and reasons for not returning to play (if applicable) were then combined with the initial surgical findings and enrollment/follow-up cohort data for analysis. This study was reviewed and approved by the ethics committee of Rajavithi Hospital.

**Results:** A total of 110 participants were recruited, with a mean age of  $35.05 \pm 9.16$  years. Most of the patients were male, single, with bachelor degree education, engaged in "other" occupations, had income up to 10,000 baht/month, were in the social security scheme (54.5%), and had no underlying diseases (85.5%). The mean  $\pm$  SD of BMI was  $25.58 \pm 4.30$  kg/m<sup>2</sup>. When classified by whether or not they returned to sports, it was found that sex, education, income and underlying disease of those who returned to sport were significantly different from those of subjects who did not ( $p < 0.05$ ). At follow-up, 36.4% had returned to sport. The main reasons stated for not returning to sport following ACL were fear of injury, concern about possible long-term effects, and worry about the possibility of re-injury. Overall, total IKDC scores of patients who returned to sport were significantly higher than those of subjects who did not. However, some points such as ability to kneel, ride and bend the knee were not different in the two groups. Bachelor degree education, monthly income lower than 10,000 Thai baht and IKDC score were the factors associated with returning to sport.

**Conclusions:** The rates of return to sport after ACL reconstruction were low compared to those of other reports in the literature. Education, low income and IKDC score were predictive factors of sport re-participation. Further studies should be carried out to assess the impact on treatment indications and rehabilitation.

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## Introduction

Anterior cruciate ligament (ACL) is the most common

ligamentous injury sustained by professional athletes at all levels of play, and its occurrence in the United States ranges from between 60,000 and 175,000 cases yearly.<sup>1</sup> In athletes, successful operations involving anterior cruciate ligament reconstruction techniques and rehabilitation have led to improved surgical outcomes and increased desire to return to play sports.<sup>2</sup> ACL reconstruction aims to get rid of functional instability, thereby decreasing the incidence of subsequent injuries.<sup>3</sup> Previous studies have revealed that the

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<https://doi.org/10.1016/j.asmart.2018.01.003>

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difference remains between expectation and actual return to sport with the latter ranging from 60% to 80% in various sports types.<sup>4–7</sup> A systematic review and meta-analysis which assessed 48 studies and 5770 patients with regard to return to sport after ACL found that while eighty-two percent of patients returned to sport, only 63% and 44% resumed their pre-injury and competitive sports respectively.<sup>5</sup> Although the outcomes after ACL reconstruction have been well-documented, athletes also require standard counseling especially on the timing of their return to sport and their levels of sports performance. Different sports types may influence the results and could also be affected after surgery.<sup>8</sup> For example, athletes who play American football experience a wide variety of aspects of the game involving size, speed and position.<sup>9</sup> ACL injury has been shown to vary depending on the position played,<sup>10</sup> some of which, such as running backs or wide receivers, require high-speed cutting and pivoting movement, while a lineman is more often subjected to direct blows to the knee.<sup>11</sup> Consequently, there are different predictive indicators for returning to sport following ACL reconstruction as a function of positional plays. It is crucial that patients be informed about these variations in order for them to be able to understand their chances of returning to their previous level of sports performance.<sup>12</sup> Additionally, sport-specific differences in outcomes following ACL reconstruction could help to optimize rehabilitation and expedite return to specific sports. In Thailand, there are few professional athletes, the majority being amateurs. Most patients who undergo ACL reconstruction surgery are students and others who exercise for recreational purposes. After ACL reconstruction, rehabilitation is needed to improve the ability and function of the knee; however, people who are not sports players may lack physical endurance, and this may be the reason for their not returning to sports after surgery. Socioeconomic factors are also associated with returning to sport.<sup>4,5</sup> Health attitudes may also differ among those who have different educational levels and income; therefore, these socioeconomic factors were included in the present study. The purpose of this research was to identify the percentage of ACL reconstruction patients who successfully returned to playing sport activities. Factors associated with being able to return to sport were also evaluated.

## Methods

### Study design

A cross-sectional study was conducted to examine the rates of return to sport of patients who had previously undergone ACL reconstruction. This study was reviewed and approved by the ethics committee of Rajavithi Hospital before database access and patient contact prior to performing data collection (EC 084/2560).

### Participants

All patients who underwent ACL reconstruction surgery between 2005 and 2015 were enrolled. The exclusion criteria were patients with multiple ligaments which could not be repaired, medial meniscectomy of up to 30%, or had mental illness that prevented them from providing information during the study. Sample size calculation based on proportion was used to determine the sample size in the present study. The proportion of return to sport, taken from that of a study by Ardern et al.<sup>5</sup> (82%), was calculated, and 30% was added to the calculated number to allow for some possible errors; hence, all 110 patients were selected. A consent form was obtained from all participants.

### Data collection

Data were collected using a questionnaire which was divided into two parts. Part I included baseline characteristics such as sex, age, education level, income level, occupation, marital status, and underlying diseases. Part II sought to obtain information on subjects' return to sport and their ability to perform using the IKDC Subjective Knee Evaluation Form. The rate of return to sport mainly focuses on only sport activities.

All potential patients were initially contacted via letter or mobile phone and asked a series of structured questions from a non-validated study-specific questionnaire regarding their participation in sports around the time of injury as well as the highest activity level attained following ACL reconstruction. Collected data from the interview, including return-to-play status, performance following ACL reconstruction, and reasons for not returning to play (if applicable) were then combined with the initial surgical and enrollment/follow-up cohort data for analysis. With regard to sports participation, the subjects were asked about their attempts to play sport since their surgery and whether they had attempted to play their pre-injury sports; they were also asked about their participation in competitive sports. Participants who changed their level of sports participation or did not return to sport were asked to indicate their reasons.

### Research tools

The 2000 IKDC Subjective Knee Evaluation Form (IKDC-Thai version)<sup>13–15</sup> was employed to record information regarding knee function in daily life activities. The IKDC was initially developed as a ligament scoring system in 1987 by a group of American and European knee surgeons. The current modified form is divided into documentation, qualification and evaluation sections, and it examines four areas (subjective assessment, symptoms, range of movement and ligament examination). Knee symptoms were evaluated using questions with a 5-point Likert scale. Subjects were asked to indicate the highest level of activities that they could participate in on a regular basis. These included very strenuous activities like jumping or pivoting as in basketball or soccer, strenuous activities like heavy physical work, skiing or tennis; moderate activities such as undemanding physical work, running or jogging; light activities like walking, housework or yard work; and inability to perform any of the activities due to giving way of the knee. Daily knee ability in activities such as going up and down stairs, squatting, and sitting with knees bent were rated using a 5-point Linkert scale as not difficult at all, minimally difficult, moderately difficult, extremely difficult and too difficult to do. The responses to each question were scored with 0 given to responses that represent the lowest level of function or highest level of symptoms. For example, item 1, which is related to the highest level of activity without significant pain is scored by assigning a score of 0 to the response "Unable to perform any of the above activities due to knee pain" and a score of 4 to the response "Very strenuous activities like jumping or pivoting as in basketball or soccer". For item 2, which is related to the frequency of pain over the past 4 weeks, the responses are reverse-scored such that "Constant" is assigned a score of 0 and "Never" is assigned a score of 10. Similarly, for item 3, the responses are reversed-scored such that "Worst pain imaginable" is assigned a score of 0 and "No pain" is assigned a score of 10. Note: previous versions of the form had a minimum item score of 1 (for example, ranging from 1 to 11). In the most recent version, all items now have a minimum score of 0 (for example, 0 to 10).<sup>15</sup> This 2000 IKDC subjective knee evaluation form is scored by summing the scores for the individual items and then transforming the score to a ranged scale from 0 to 100. The

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