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# Anterior Cruciate Ligament Functional Sports Assessment

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The incidence of anterior cruciate ligament (ACL) patients has doubled in the past 5 years at Rush University Orthopaedics. Additionally, there has been a 3-fold increase in the number of anterior cruciate ligament injuries in patients younger than the age of 25 years of age during this 5-year period. Fortunately, approximately 80%-90% of these patients return to their sports at their previous level of play. However, with the increased incidence in tears, it is important for medical providers to assist the patients in determining the risk factors they may display when preparing to return to sport. There are very few published return to sport guidelines following anterior cruciate ligament reconstruction. Midwest Orthopaedics at Rush has developed a functional sports assessment (FSA) to evaluate anterior cruciate ligament injury risk factors on postoperative patients. The FSA factors include range-of-motion, strength, endurance, proprioception, power, core stability, ankle stability, and overall biomechanics and confidence. Although the FSA has not been proven reliable or valid, it is based on the other commonly used tasks in determining a patient's ability after anterior cruciate ligament surgery. It has been clinically relevant for the patient, therapist, athletic trainer, and physician in identifying weaknesses and risk factors at the 5-6 month time postoperative time period. This helps to guide the patient in what tasks he or she needs to be attentive to during the transition to return to sport to minimize reinjury. This article provides factors that were considered when developing the FSA, a detailed description of the FSA, and future considerations to improve the assessment for validity and reliability.

Oper Tech Sports Med 24:59-64 © 2015 Elsevier Inc. All rights reserved.

**KEYWORDS** anterior cruciate ligament, functional assessment, return to sport

The incidence of anterior cruciate ligament (ACL) injuries is 400,000-500,000 per year.<sup>1</sup> In the United States alone, anterior cruciate ligament reconstruction is performed in 175,000 patients.<sup>2</sup> The rehabilitation following anterior cruciate ligament reconstruction is critical in achieving a successful clinical outcome. There are variations of rehabilitation protocols but most are based in an accelerated program that facilitates early motion, recovery of strength, and return to

previous level of function. The return to function often includes sport specific activities. This consists of running, jumping, landing, cutting, stopping, and starting and ability to tolerate any contact related to the sport they are returning to. For most of the patients, the procedure is successful but failure rates average 3% but has been reported as high as 10%-25%.<sup>3</sup> Considering the cost and time spent on an anterior cruciate ligament reconstruction in addition to the mental time away from activity, a discussion about safe return to sport is a very important topic.

The timeline in deciding when to return an athlete to sports after anterior cruciate ligament reconstruction can be controversial. It is important to use standardized outcome measure in research and clinical practice. However, objective guidelines are infrequently used to determine when an athlete is ready to safely return to sport. There are few valid and reliable outcome measures in the literature. Factors to consider can include

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range-of-motion (ROM), strength, pain, outcome scores, and functional performance. It is imperative that the dynamic component of the performance is considered to decrease the possibility of reinjury.

The objective of this article is to review the return to sport protocols in the literature as it relates to the Midwest Orthopaedics at Rush Functional Sports Assessment (FSA). The assessment was developed to assist the orthopedic physicians and physical therapists in determining the deficits and strengths of postoperative anterior cruciate ligament patients, as they are preparing to return to sport. It is used to clarify what tasks the athlete needs to focus on, to perform sport specific activities with minimal risk.

Our objective in creating the FSA was to evaluate as many modifiable ACL injury risk factors as possible whereas adhering to constraints that limit most physical therapy clinics. For the purpose of the FSA, the modifiable ACL injury risk factors were ROM in the lower extremities, strength and power symmetry of the lower extremities, quadriceps dominance, proprioception, endurance, core stability, ankle stability, overall quality of biomechanics with high-risk athletic movements, and confidence in the knee. Constraints placed on our approach to testing protocols were that the FSA needed to take 60 minutes or less to complete, use common equipment found in a PT clinic, be able to be performed in a small area (6 m × 3 m), use the movements in all 3 planes, be relevant, be reliable, provide immediate feedback that the patient can use to reduce their injury risk factors, and provide data that the patient's physician can use as a component in the return to play decision.

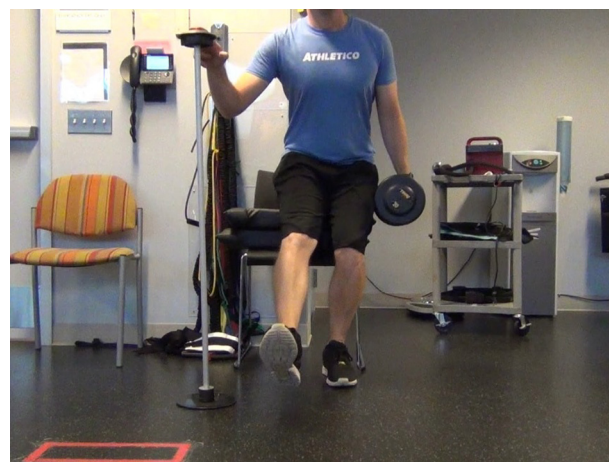
Patients are strongly encouraged to have met the criteria described below performing the FSA. Patients should allow at least 20 weeks since their date of surgery, have experience with lateral movement, pivoting, and plyometrics, report pain levels less than a 3/10 with activities of daily living and current exercises, be prepared to begin the transition back to their sport in the next month, and have a physician's clearance specifically for the FSA.

The FSA consists of 9 different sections—a knee and ankle ROM assessment, single leg hop, triple hop, crossover triple hop, 6 m timed hop, single leg squatting, lateral jumping, and pivoting, 6 m straight line run with a change in direction, and a plyometric box jump assessment. The patient's test is recorded with 1-2 video cameras and the video is analyzed afterwards with the patient present to discuss deficits noted. Video footage is also analyzed by the test administrator afterwards for more comprehensive identification of deficits.

Patients are instructed to wear athletic clothing and shoes that they wear for their regular athletic activity and training. Patients that would be utilizing a brace when they return to their sport are instructed to wear their brace during testing. Patients are allowed to warm up utilizing any method with which they are comfortable and familiar.

## ROM Assessment

The FSA ROM assessment consists of goniometric assessment of ankle dorsiflexion, knee flexion, and knee extension. The



**Figure 1** Single Leg Squat Front View (Color version of figure is available online.)

purpose of this ROM testing in the FSA is to identify significant ROM restrictions that would inhibit progressing with the remainder of the test. For the purposes of the FSA, the patient is expected to achieve 20° of ankle dorsiflexion bilaterally, symmetric knee extension, and 120° of knee flexion bilaterally.

## Single Leg Hop

The single leg hop assessment requires the patient to stand on 1 leg and hop as far as possible, land on the same limb, and maintain their balance for 2 seconds. Inability to maintain balance invalidates that attempt. Measurements are then taken from the patient's heel to the nearest centimeter. This process is repeated, alternating between the unaffected and affected side until 3 measurements are taken on each leg.

Single-leg performance-based measures used to assess the combination of muscle strength and power, neuromuscular control, confidence in the repair knee, and the ability to tolerate loads related to sports-specific activities following surgical and rehabilitative interventions.<sup>4-7</sup> In our opinion, the 4 hop tests progress from the least difficult to the most



**Figure 2** Single Leg Squat Side View (Color version of figure is available online.)

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