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Predictive Value of the Functional Movement Screen as it Relates to Anterior Cruciate Ligament Injury

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ABSTRACT

Anterior cruciate ligament injuries occur over 200,000 times annually in the United States alone (Brophy, et al. 2009). This injury strains the healthcare system and affects the players, teams, parents, and the organization they are a part of. There have been, however, clinically researched risk factors that predispose athletes to ACL injury (Gignac, et al. 2015; Laible, et al. 2014). As a result, there is a clinical need for an effective screening tool to identify those athletes at risk for ACL injury. The Functional Movement Screen has been shown to be an effective screening tool for detecting athletes who are at a greater risk for generalized injury, but its predictive value has never been tested for specific injury rates (Kiesel, et al. 2007; Chorba, et al. 2010; Kiesel, et al. 2015; Letafatkar, et al. 2014). We performed a prospective study on 20 freshman participants who were athletes on a NCAA Division II varsity soccer, basketball, or volleyball team. The results of the study to this point include one men's soccer athlete with a torn ACL and an FMS score of 19, leading us to believe that no correlation exists between FMS score and incidence of ACL injury at this time. The purpose of this study was to determine if FMS can be an effective tool for predicting risk of ACL injury in athletes.

INTRODUCTION

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Anterior cruciate ligament injuries occur over 200,000 times annually in the United States alone (Brophy, et al. 2009). Injuries to the ACL typically result in ACL reconstruction surgery, which requires between 8-16 months for recovery (Brophy, et al. 2009). This injury has multiple adverse effects on the athlete besides the physical pain and discomfort (Gignac, et al. 2015). Psychological, social, and financial effects, as well as future complications such as osteoarthritis have been noted in the literature (Gignac, et al. 2015; Laible, et al. 2014). The risk factors and mechanisms of ACL injury have been studied extensively, but still no predominant risk factor or mechanism exists (Laible, et al. 2014; Alentorn-Geli, et al. 2009). Risk factors such as narrow femoral notch width, slope of the tibial plateau, and hormonal imbalances are non-modifiable and difficult to assess without expensive testing (Laible, et al. 2014; Alentorn-Geli, et al. 2009; Evans, et al. 2012; Anderson, et al. 1987; Ruedl, et al. 2009; Feucht, et al. 2013). There are modifiable risk factors, however, which when addressed in a prevention program have been shown to decrease incidence of non-contact ACL injury (Alentorn-Geli, et al. 2009; Evans, et al. 2012; Blackburn, et al. 2013; Hewett, et al. 2005).

The functional movement screen is a seven test system used to quantify the quality of an athlete's functional movement. It consists of the deep squat, hurdle step, in-line lunge, active straight-leg raise, trunk stability push-up, shoulder mobility test, and rotary stability test (Burton, et al. 2010). Each of the aforementioned tests are scored on a scale of 0-3. A zero is awarded if the athlete experiences pain at any point during the test, a 1 is awarded if the athlete is unable to perform the test, a 2 is awarded if the athlete is able to perform the test with a compensation, and a 3 is awarded if the athletes is able to perform the test perfectly without any compensations. The individual scores are then added up to create the athletes' composite score (Burton, et al. 2010). This composite score is used to determine an athlete's level of risk for sustaining a non-contact injury. it is generally accepted that a composite score of less than 14 places an athlete at a greatly increased risk for injury (Kiesel, et al. 2007). Therefore, the purpose of this study was to determine the efficacy of using FMS as a screening tool to identify athletes who are at an increased risk for ACL injury.

PURPOSE

The purpose of this study was to determine if FMS can be an effective tool for predicting risk of ACL injury in athletes so that they can be placed into a preventative program.

METHODS

Inclusion and Exclusion Criteria

This study included 20 freshmen athletes participating in varsity volleyball, basketball, or soccer at an NCAA Division II University in Ohio. This study included 8 males and 12 females. There were 6 men's soccer athletes, 7 women's soccer athletes, 3 women's volleyball athletes, 2 women's basketball athletes, and 2 men's basketball athletes. The study excluded any athletes who were under the age of 18, in rehabilitation for a current injury, or who did not sign the informed consent form. Before participating in the study, all subjects read and signed an informed consent form approved by the University's Institutional Review Board for the Protection of Human Subjects, which also approved the study.

Instrumentation

This study used the Functional Movement Screen. This is a seven exercise screen that is used to help determine functional deficits in an individual's movement patterns. See Figures 1-7.

Procedures

The Functional Movement exam was conducted by clinicians trained in the Functional Movement Screen scoring system. The examiners performed The Functional Movement Screen with all of the athletes that met the inclusion criteria in conjunction with the University's pre-participation physical examination. The examiners confidentially recorded each athlete's Functional Movement Screen score and then longitudinally tracked their injury status throughout their respective seasons. Any potential ACL injuries were reported to the researchers by the athletic trainer assigned to the athlete's sport. ACL injuries were to be diagnosed via an MRI. In addition, any other injuries sustained by the athletes were also reported and tracked. This was the beginning of the first phases of a four-year prospective study that will be continued by future researchers. At the beginning of each future season, the participants will be re-tested and awarded a new FMS score. At the end of the four years, the researchers will determine whether or not there was a correlation between a low FMS score and ACL injuries. If there is a correlation, the researchers will determine what FMS score proves to be most accurate.

STATISTICAL ANALYSIS

Due to the lack of data points, we were unable to perform any clinically significant statistical analysis. The hope is that over the remaining three years of this study more data will be gathered so that this can be performed with significance.

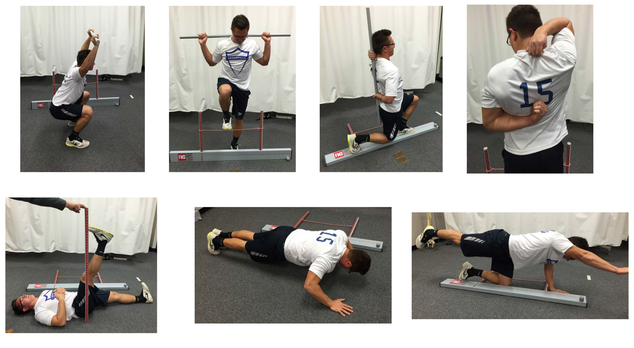
RESULTS

The 20 athletes screened had a mean FMS score of 17.2, with a high score of 20 and low of 12. The athletes screened consisted of 6 men's soccer athletes, 7 women's soccer athletes, 3 volleyball athletes, 2 women's basketball athletes, and 2 men's basketball athletes who were all freshman varsity athletes. Table 1 shows the scores for the different sports. Although the study is not yet complete, at this point one men's soccer athlete has a torn ACL, and his FMS score was 19.

Table 1. FMS Scores for Different Sports

Sport	Distribution of Scores
Men's Soccer	12, 17, 17, 17, 17, 19
Women's Soccer	16, 18, 18, 18, 18, 19, 20
Women's Volleyball	16, 17, 18
Men's Basketball	16, 16
Women's Basketball	16, 19

Figures 1-7.



DISCUSSION

There have been studies conducted on the predictive value of FMS, but all have been for generalized injury, including upper and lower extremities (Kiesel, et al. 2007; Chorba, et al. 2010; Kiesel, et al. 2014; Letafatkar, et al. 2014). In addition, all the previous studies defined an injury based on time lost from practice or competition (Kiesel, et al. 2007; Chorba, et al. 2010; Kiesel, et al. 2014; Letafatkar, et al. 2014). This study was designed to assess the predictive value of FMS for a specific injury, that being injury of the ACL. Our definition of an ACL injury was that it had to be diagnosed by a certified athletic trainer or sports medicine doctor along with a confirming MRI. The purpose of identifying the predictive value of FMS in regards to incidence of ACL injury was to potentially identify an effective screening tool to identify athletes who are at a greater risk for ACL injury. Once identified, these athletes could be placed into an ACL prevention program to attempt to control the modifiable risk factors for ACL injury, and thus reduce overall incidence of ACL injury (Laible, et al. 2014). Through this point in the study, there is no correlation between FMS score and ACL injury. The single athlete who suffered an ACL tear had an impressive FMS score of 19, meaning that he performed over half of the movement tests without any compensation.

Limitations

There were several limitations to this study. Both of the researchers were trained in FMS prior to this study, but neither had any patient experience with FMS outside of supervision and instruction. The researchers were also not trained in an official FMS course, but rather were instructed by a healthcare professional who was certified in FMS. The researchers were also unable to screen 2 men's soccer athletes, 2 volleyball athletes, and 6 men's basketball athletes due to unresponsiveness to e-mail prompts. The sample size was also too small to be statistically significant, having only 20 participants.

CONCLUSION

The aim of this study is to decrease the number of ACL injuries in athletics through early identification and preventative care. ACL injuries have a debilitating effect on an athlete psychologically, physiologically, socially, and financially (Gignac, et al. 2015; Laible, et al. 2014). The secondary goal of this study is to decrease the number of ACL injuries in athletics through early identification and preventative care. Preventing ACL injuries is the best way to avoid these complications. There are several risk factors that have been identified to increase the risk of ACL injury (Laible, et al. 2014; Alentorn-Geli, et al. 2009; Evans, et al. 2012; Anderson, et al. 1987; Ruedl, et al. 2009; Feucht, et al. 2013) . One such factor is decreased functional skill. Several different functional screens have been developed to provide clinicians with usable data about an athlete's functional ability. The Functional Movement Screen is the most comprehensive functional exam in the current literature (Burton, et al. 2010). It includes movement tests for the whole body as well as accounting for bilateral asymmetries. It has been shown to have clinical implications for predicting injury in athletes (Kiesel, et al. 2007; Chorba, et al. 2010; Kiesel, et al. 2014; Letafatkar, et al. 2014). In the future, this study will be significant to the sports medicine community because it will provide clinicians with an effective tool to identify those athletes at an increased risk of ACL injury.