The Functional Movement Screen and Injury Prevalence in Collegiate Athletes

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Introduction

The Functional Movement Screen™ (FMS) is an evaluation tool that utilizes seven complex movements to assess an individual's functional movement pattern and accentuate asymmetries or limitations of movement. It was originally designed as a quick and systematic screening guide to assist health and wellness professionals in identifying poor fundamental movement patterns in patients and clients. The athletic population has been progressively incorporating the FMS in to pre-season physical fitness examinations.

Although the FMS is not necessarily a diagnostic tool, research has found a cutoff score associated with increased risk of injury which has led to interest in utilizing the FMS for guiding preventative measures for athletes. The FMS consists of seven fundamental movement patterns that include the deep squat, the hurdle step, the in-line lunge, the shoulder mobility test, the active straight-leg raise, the trunk stability push-up, and the rotary stability tests (Cook and Burton, 2010). The individual can receive a score of 3, 2, 1, or 0 for each test and a composite score between 0 and 21 points (Teyhen et al., 2012). The movements of the FMS have been specifically designed to stress an individual's functional movement limits so that their range of motion, dynamic stabilization, and balance deficits can be exposed.

The FMS is unlike other assessments currently in use because of its comprehensive analysis of movements as a whole and the dynamic nature of the screening. Analysis of whole movements should precede analysis of physical fitness, performance, or movement parts because compensatory and maladaptive movement patterns may be hidden behind excellent performances and fitness levels as athletes have learned to compete at high levels despite adoption of non-ideal movements. The issue arises when fundamental mobility and stability patterns place abnormal stresses on the musculoskeletal system and these observed limitations may lead to increased risk of injury (Burton, Kiesel, Rose, & Bryant, 2010). Current research demonstrates that the FMS may play a large role in improved performance and a reduction of injury (Cook & Burton, 2010).

Purpose/Research Question

Research has found that an FMS threshold score of less than or equal to 14 is a valid cutoff score for injury risk screening in contact sports, firefighters, and tactical professions of the male population. More research on a threshold FMS score for female endurance and non-contact sports is needed (Burton, Kiesel, Rose, & Bryant, 2010; Butler, Contreras & Curton, 2012; Kiesel, Plisky, & Voight, 2007; O'Connor, Deuster, & Davis, 2011). The purpose of this study was to determine if FMS scores can predict injury occurrence over one athletic season for female collegiate athletes. Specifically, the research question asks, 'Can FMS scores predict the occurrence of injuries in female collegiate Division I swimming, diving, or cheerleading athletes during one competitive season?'.

Methods and Materials

A total of fifty-one NCAA Division I female athletes were screened including thirty-three swimmers, fifteen cheerleaders, and three divers. Three of the swimmers were not included in the final results of the study resulting in a total of forty-eight (*n*=48) athletes included. FMS screenings took place at the beginning of their respective athletic seasons and injuries were recorded for the fifteen weeks following. The team athletic trainers recorded injury occurrence, treatment, and referral to other healthcare providers in the standardized ATS computer system used for all of the athlete's medical records.

Results

The FMS scoring ranges from 0-21 with 21 indicating all movements were performed appropriately, without pain and no asymmetries observed. Participants in this study scored composite FMS scores which ranged from 8 to 18 with a mean FMS score of 13.9 ± 2.26 for all (n=48)participants. The average FMS score for cheerleaders was 14.4 ± 1.70 which was higher than that for swimmers and divers who scored an average of 13.6 ± 2.41. This data indicates that a majority of the athletes were observed to have asymmetries in movement, compensatory patterns, or pain during the evaluation which limited their performance and completion of the functional movements. Based on the previously found cutoff score of 14 or less indicating an increased risk of injury and the low mean composite score of the athletes, it would be expected that about half of the athletes would incur an injury, however the data does not support this conclusion. Of the 48 athletes included, 16 total injuries occurred during the 15 week study. The logistic regression found the FMS score was not a significant predictor (p=0.927) of injury and there was no cutoff score signifying an increased risk for injury. Since p=0.927 the null hypothesis cannot be rejected. When a score of 14 is put in to the logistic regression equation (logit(p) = -.867+.013 x (FMS score)) (logit)p (for sustaining an injury) value was found to be .335 (below .5) which indicates that an FMS score of 14 would inaccurately predict an injury due to it being more likely an injury would not occur. Logistic regression analysis also found Exp(B) (odds ratio) to be 1.013 which indicates that for any FMS score there is a 1.013 times increased likelihood of an injury occurring rather than no injury occurring indicating that the odds of sustaining an injury or not sustaining an injury is equally likely. The pseudo R^2 value is 0 indicating that this model does not explain the variability of the response data around the mean. Overall, in this sample of athletes, the FMS score was not a significant predictor of risk for injury and no cutoff score for injury risk was indicated.

Table 1. Logistic Regression Analysis Results.

Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	FMS Score	.013	.137	.008	1	.927	1.013
	Constant	-.867	1.935	.201	1	.654	.420

Figure 1. Deep Squat.

Figure 2. In Line Lunge

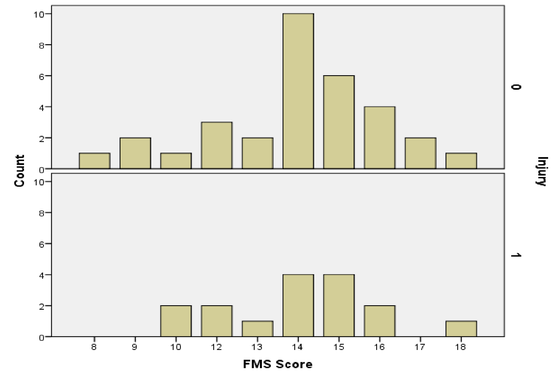
Figure 3. Rotary Stability

Figure 4. Hurdle Step

Discussion

- One factor that was not a part of this study that may improve future studies would be to additionally consider the relationship of pain during the FMS with injury risk
- Factors such as previous history of injury, age, BMI, and aerobic fitness should also be considered when categorizing an individual's risk of injury to help create a more holistic picture of the individual.
- This study relied on self-report of injuries by the athletes and it is possible that athletes were hesitant to reveal an injury due to the potential of jeopardizing their ability to participate
- Future studies should consider tracking injuries over several athletic seasons in order to have an extended period for data collection and to include injuries that occur during off-season and pre- season in addition to in-season training and competition.
- A potential covariate to be considered is hours of playing time by each participant.

Figure 5. FMS Score and Injury Occurrence.



Conclusions

The FMS is not a significant predictor of injury in Division I female swimmers, divers, or cheerleaders and thus there is not a specific cutoff score indicating increased risk for injury as previous studies have found with other populations. There are unique patterns among the individual component scores of the FMS that vary between the two athletic populations tested. This indicates that the individual movement results of the FMS in addition to the composite score are valuable in identifying individual weaknesses, compensations, asymmetries, and dysfunctional movement patterns to address with proper therapy or training and in turn, potentially reduce the athlete's risk of injury.

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