INTRODUCTION

The Functional Movement Screen (FMS) is a series of 7 fundamental movements scored using a 4 point ordinal scale (3-0) to examine the risk of injury based on total score (21-0) and/or side to side asymmetry [1]. The movements include deep squat, hurdle step, inline lunge, shoulder mobility, active straight leg raise, trunk stability pushup, and rotational stability. Asymmetry is noted in 5 movements performed bilaterally: hurdle step, inline lunge, shoulder mobility, active straight leg raise, and rotational stability. The score for the FMS is determined by specific criteria for each movement [1] with a 1 indicating inability to perform the movement, 2 corresponding to performing the movement with compensation, and 3 corresponding to the ability to correctly complete the movement without compensation. If there is pain during any portion of the movement or pain with a clearing test, a score of 0 is given [1].

The FMS has been described as an injury predictor with a score below 14 associated with an increased risk of serious injury in professional football players [2]. Since musculoskeletal injury is an inherent risk for anyone involved in athletics, a screening system that is able to assess injury risk due to aberrant movement patterns is critical. Currently two previous interrater reliability studies for the FMS using the standard scoring system have been published [3,4] and one also investigated intrarater reliability [4]. Minick et al. [3] used video and tested the ability of two expert and two novice raters’ scores based on anterior and lateral viewpoints. The use of video with set viewpoints does not represent administration or scoring of an actual FMS that requires the clinician to move and see from multiple viewpoints during a single trial, especially for lunge and rotary stability tests [3]. Teyhan et al. [4] used only novice raters (n=8) to determine inter and intrarater reliability which did not allow for comparison with experienced or certified FMS raters. Despite the stated limitations, the previous studies demonstrated high [3] to good [4] interrater reliability and moderate intrarater reliability [4].

Therefore, the purpose of this study was to test the interrater and intrarater reliability of the FMS following a single two hour education session with raters of different educational background and experience levels with FMS administration in healthy, injury-free men and women.

METHODS

To determine the interrater and intrarater reliability of the FMS, four raters observed the participants complete the FMS using the standard instructions on two separate days (7 days apart). At the beginning of the study a two hour training session was conducted using materials from the creators of the FMS [1]. This session was led by a non-certified, but experienced FMS tester and covered the 7 movements, the 3 clearing tests, the verbal instructions, and scoring criteria.

The four raters included a certified FMS tester (Rater 1); an entry-level physical therapy student who had completed over 100 FMS tests, but was not certified (Rater 2); a faculty member in Athletic Training with a PhD in Biomechanics & Movement Science, but no previous experience with FMS (Rater 3); and an entry-level physical therapy student with no previous experience with FMS (Rater 4).

Data to calculate intra- and inter-rater reliability of the FMS was collected in a convenience sample of 19 healthy, injury-free men (n = 10) and women (n = 9).
The instructions for the screen were taken from the standardized protocol from the most recent FMS text [1]. These instructions were recorded on audio with pictures taken for each setup and starting position. The audio and pictures were combined into videos that were shown to each participant before the movement was performed.

Each participant began each session with a 5 minute warm-up on a stationary bicycle. After warming up, the tibial tuberosity height and hand length from the longest finger to the distal crease of the wrist were measured by all four raters. The measurements of Rater 2 were randomly selected to be used during all testing sessions for setting hurdle height, the distance between the feet on the inline lunge, and scoring for the shoulder mobility.

The participant was instructed to listen to the videos, assume the proper starting position, and repeat the movement 3 times. After the last movement, the video for the next movement in the FMS was played. At the conclusion of the first testing, the participants were instructed to return the following week for retesting with the same shoes. The participants were also instructed not to practice any of the movements between the two testing sessions to limit a learning effect in movement patterns. The same procedure was followed for the second testing to determine intrarater reliability; intrarater reliability was computed for both testing sessions.

Descriptive statistics were calculated as means with standard deviation for normal interval data and medians with range or percent for non-normal or categorical data. Intra-class correlation coefficients (ICC) from an analysis of variance (ANOVA) were calculated to determine by intra- and interrater reliability. All analyses were completed using SAS, Version 9.2.

RESULTS AND DISCUSSION

The sample included 9 women and 10 men and was aged (median [range]) 26 [22-41] years and overall was normal weight (body mass index 24.0±2.9 kg/m²). The overall FMS scores ranged from 11 to 17 with a mean ± SD of 14.3±1.7 (using testing session number 1 and Rater 3 as an example). Overall, inter-rater reliability was good for session one (ICC = 0.89) and for session two (ICC = 0.87). Additionally, there was 100% agreement with the 3 clearing tests amongst all of the raters. Intrarater reliability was acceptable to good for each rater (Table 1).

Contrary to expectations, the certified FMS rater had the lowest intrarater ICC. While this rater demonstrated acceptable intrarater reliability (ICC=0.81), certification did not improve this reliability. Further, the most consistent rater had no previous FMS experience but did have the most education and experience in movement analysis (Rater 3). Therefore intrarater reliability with the FMS may be increased with more structured education and experience in movement analysis.

CONCLUSIONS

In this small study of injury free men and women the results show the FMS could be accurately scored by people with a varying degree of experience with the FMS. Also, a single two-hour training session was sufficient for reliable scoring.

REFERENCES


Table 1: Intra-class correlation coefficients for intra-rater reliability

<table>
<thead>
<tr>
<th>Rater Number</th>
<th>Rater Description</th>
<th>ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Certified FMS tester</td>
<td>0.81</td>
</tr>
<tr>
<td>2</td>
<td>Physical therapy student. Non-certified, experienced FMS tester</td>
<td>0.90</td>
</tr>
<tr>
<td>3</td>
<td>Athletic Training Faculty member. Non-certified, inexperienced FMS tester</td>
<td>0.91</td>
</tr>
<tr>
<td>4</td>
<td>Physical therapy student. Non-certified, inexperienced FMS tester</td>
<td>0.88</td>
</tr>
</tbody>
</table>