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Mackenzie Cole

Marissa McCollister

Neil Greier

Siobhan Fagan

Andrew W. Froehle

See next page for additional authors

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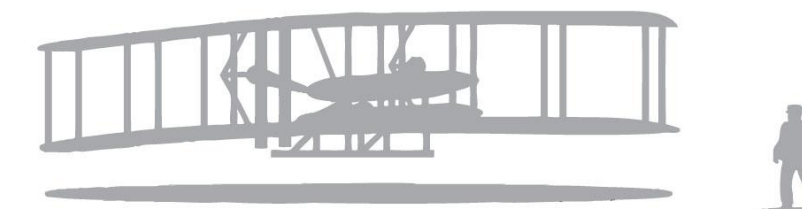
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Authors

Mackenzie Cole, Marissa McCollister, Neil Greier, Siobhan Fagan, Andrew W. Froehle, Nicholas Curry, Jason Bradford, Brad Muse, and Scott Bruce

ASSESSMENT OF FUNCTIONAL MOVEMENT SCREENING BY ASSESSORS OF THREE DIFFERENT SKILL LEVELS

Mackenzie Cole, ATC, Marissa McCollister, ATC, Neil Greier, ATC, Siobhan Fagan, MEd, AT, ATC, CSCS, Andrew Froehle, PhD, Nicholas Curry, DC, CCSP, ATC, CSCS, CGFI, Jason Bradford, MEd, CSCS, Brad Muse, MA, AT, ATC, Scott L. Bruce, EdD, AT, ATC



BACKGROUND AND PURPOSE

- The Functional Movement Screen™ (FMS) is a series of 7 physical tests¹
- FMS screens fundamental movement patterns that require mobility, stability, and motor control²
- FMS is comprised of deep squat (DS), hurdle step (HS), in-line lunge (IL), shoulder mobility (ShM), active straight leg raise (ASLR), trunk stability push-up (TSP), and rotary stability (RS)¹ (Figures 1-4)
- Sports medicine clinicians use FMS to assess for dysfunctional movement patterns²
 - FMS is not intended to be a diagnostic tool²
- The inter-rater reliability for FMS has values ranging from 0.37 to .95^{3,6,7,8}
- The intra-rater reliability for FMS has values ranging from 0.76 to 0.98^{4,6,7,8}
- FMS was designed as a means of filling the void between pre-participation screenings and performance tests⁵
- A lack of uniform definitions for varying skill levels of FMS raters creates difficulty in the interpretation of the studies
- The purpose of this study was to examine the intra- and inter-rater reliability on the FMS by novice, intermediate, & expert level raters

PARTICIPANT CHARACTERISTICS

- 20 healthy, physically active, college students: 13 males and 7 females (Table 1)
- Subjects who had suffered a musculoskeletal injury within the last 6 months were excluded
- Six raters were used to assess subjects performing the various FMS exercises
 - Operationally defined rater skills level were as follows:
 - Expert raters had at least 5 years of experience of FMS assessment
 - Intermediate raters had ≥ 2 years, but < 5 years of experience in FMS assessment
 - Novice raters untrained in FMS assessment & had observed FMS less than 6 times

Table 1. Descriptive statistics of subjects

| | All Subjects | Females | Males |
|-------------|-----------------|-----------------|-----------------|
| Age (years) | 21.0 (± 2.05) | 20.71 (±1.98) | 21.15 (±2.15) |
| Height (cm) | 172.15 (± 7.74) | 165.28 (± 6.97) | 175.85 (± 5.30) |
| Weight (kg) | 76.96 (± 12.05) | 68.67 (± 11.56) | 81.43 (± 10.07) |
| BMI | 25.98 (± 3.83) | 25.22 (± 4.55) | 26.38 (± 3.51) |

Figure 1. Trunk stability push-up



METHODS

- Participants arrived at biomechanical laboratory & were briefed on the testing procedures
- Reflective markers were attached on the subjects' major joints & key anatomical landmarks
- A research team member read the FMS script instructing subjects on how to do each mvt
- Anterior & both lateral views were video taped using GoPro Cameras, (San Mateo CA)
- Exercises were performed in the order as recommended by the FMS protocol
- Videos were assessed by 2 expert raters, 2 intermediate raters and 2 novice raters
- Raters scored all 20 participants using the FMS scoring sheet on a 0-3 scale
 - 3 = performs movement correctly¹
 - 2 = completes mvt with compensation¹
 - 1 = not able to preform the mvt¹
 - 0 = pain¹
- One week later video assessment of all 20 subjects was performed again by the same raters
- Statistical analysis included ICC and Cohen's Kappa

Figure 2. Deep squat: A, anterior view; B, lateral view

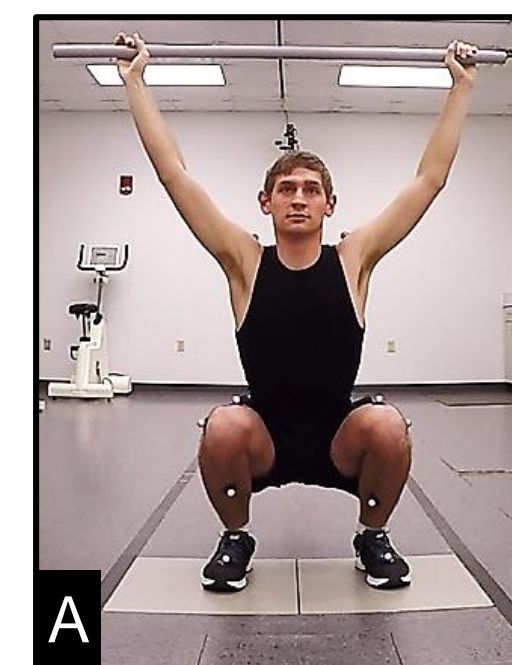


Figure 3. Hurdle step: A, anterior view; B, lateral view

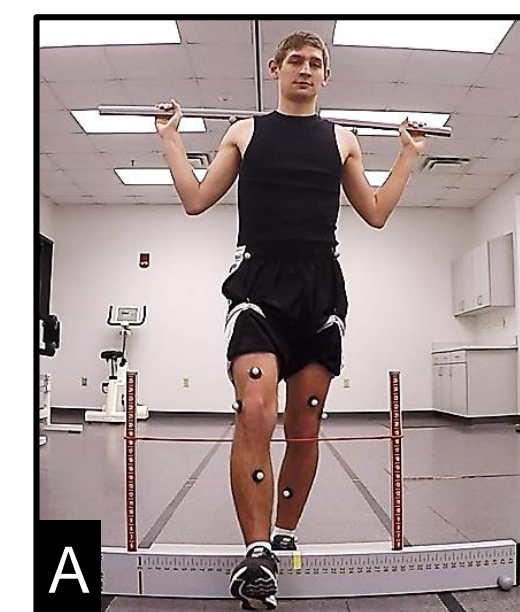
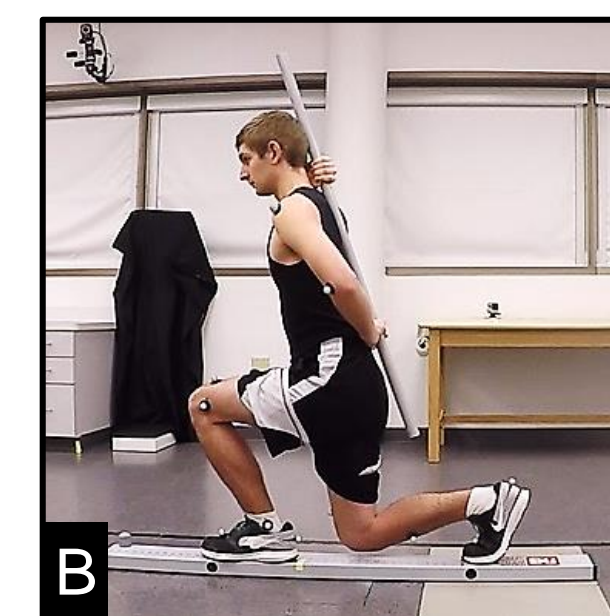


Figure 4. In-line lunge: A, anterior view; B, lateral view



RESULTS

- "Intermediate" raters had slightly better ICC mean than the "expert" raters (Table 2)
- Mean inter-rater reliability across all exercises was best for the intermediate pairing (Table 3)
- Best mean of mixed pairings of raters were Int1-Exp1 (0.70); Int1-Exp2 (0.64); Int2-Exp2 (0.57)

Table 2. Pooled ICCs

| Rater | Pooled ICC: 1st trial vs. 2nd trial | High ICC | Low ICC |
|-------|-------------------------------------|-------------------|-------------|
| Nov1 | 0.773 | TSP = 0.923 | HS = 0.503 |
| Nov2 | 0.602 | TSP = 0.905 | DS = -0.053 |
| Int1 | 0.983 | 6 mvts = 1.000 ea | TPS = 0.878 |
| Int2 | 0.805 | DS = 1.000 | IL = 0.516 |
| Exp1 | 0.959 | 6 mvts = 1.000 ea | ShM = 0.713 |
| Exp2 | 0.818 | HS & ASLR = 1.000 | RS = 0.622 |

Table 3. Cohen's Kappa

| | DS | HS | IL | ShM | ASLR | TSP | RS | Mean | Combo Mean |
|-------------|-------|--------|-------|-------|-------|--------|-------|-------|------------|
| Nov1 - Nov2 | 0.123 | 0.583 | 0.375 | 0.294 | 0.103 | 0.583 | 0.342 | 0.343 | 0.290 |
| Nov1 - Nov2 | 0.076 | 0.494 | 0.268 | 0.219 | 0.054 | 0.494 | 0.048 | 0.236 | |
| Int1-Int2 | 1.000 | 0.242 | 0.604 | 0.542 | 0.771 | 0.242 | 0.510 | 0.559 | 0.523 |
| Int1-Int2 | 1.000 | 0.174 | 0.406 | 0.538 | 0.768 | 0.174 | 0.355 | 0.488 | |
| Exp1-Exp2 | 0.706 | 0.020 | 0.425 | 0.844 | 0.464 | 0.020 | 0.412 | 0.413 | 0.380 |
| Exp1-Exp2 | 0.630 | -0.033 | 0.416 | 0.700 | 0.439 | -0.033 | 0.313 | 0.347 | |

EVIDENCE-BASED RECOMMENDATIONS / CLINICAL RELEVANCE

- Our results show that raters with experience assessing the FMS seem to score more consistently throughout
- Novice raters appear to be able to successfully assess the FMS, but lack of experience leads to inconsistent scores
- Lack of consistency for both intra- & inter-rater reliability across the 7 movements regardless of raters' skill is concern

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