INTERRATER AND INTRARATER RELIABILITY OF MOVEMENT COMPETENCY

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This study establishes the interrater and intrarater reliability of Movement Competency Screen (MCS). Nine male and six female MCS video data from the national dragonboat team were utilized in the study. Prior to the video recording, the athletes performed a standardized warm-up followed by a 2-minute active rest. Two raters scored data for two occasions after 6 and 7 days respectively. Intraclass correlation coefficient (ICC), 95% confidence interval (95% CI), typical error (TE), typical error as a %CV, and smallest worthwhile change (SWC) were used to identify absolute and relative interrater and intrarater reliability. For Day 1, interrater relative reliability was 0.43 (ICC) with 95% CI (-0.08, 0.76). TE was 0.77 with 1.80 %CV and 0.63 SWC. In Day 2, interrater relative reliability was 0.56 ICC with 95% CI (0.09, 0.83). TE = 0.69, %CV was 1.50 and SWC was 0.53. Intrarater ICC for rater 1 was 0.98 with 95% CI ranging from 0.93 to 0.99. TE was 0.17, %CV was 0.05 and SWC was 0.18. Rater 2 posted .76 ICC with 95% CI range from 0.42 to 0.91. Also, TE was 0.52, %CV was 0.60 and SWC was 0.23. Interrater absolute reliability was marginal for both days. Interrater relative reliability was considered poor for Day 1 and moderate in Day 2. Absolute intrarater reliability was good for rater 1 and marginal for rater 2. Intrarater relative reliability was high for both raters.

KEYWORDS: movement competency, screening tool, interrater reliability, intrarater reliability

INTRODUCTION

MOVEMENT COMPETENCY AND subsequent production of muscular power is a fundamental concern for sport and health professionals when considering an athlete's injury prevention and long-term athlete development. Sport and health professionals endeavor not only to develop and enhance an athlete's physical prowess but also to minimize their training and competing time lost due to soft tissue injuries. This is evident in research devoted to investigating mechanisms of soft tissue injuries (Myer, Ford, & Hewett, 2010; Paterno et al., 2010; Alethorn-Geli et al., 2009a; Alethorn-Geli et al., 2009b; Myer, Chu, Brent, & Hewett, 2008; Myer, Ford, & Hewett, 2004). More recent efforts have been made to investigate the effectiveness of screening complex movements to assist with the understanding of how movement strategies, involving the kinetic chain, influence athletic performance and contribute chronically and/or acutely to the mechanisms of soft tissue injuries (Butler et al.,, 2010; Minick et al., 2010; Kiesel, Plisky, & Butler, 2009; Kiesel, Plisky, & Voight, 2007). It is has been reported that traditional isolated muscle and joint assessments, common to many athlete pre-participation examinations and muscle balance assessments, fail to link how the kinetic chain responds to muscle weakness and joint instability during fundamental movement patterns (Quatman et al., 2009).

The Functional Movement Screen (FMS) is a screening tool that has gained popularity among practitioners (Cook, Burton, & Hogenboom, 2006a; Cook, Burton, & Hogenboom, 2006b). FMS seeks to identify potential deficiencies contributing to injury or weakness using seven whole body movements and specialized equipment. Given the propensity of its utilization in the field, there has been no reported validity study of FMS (Kritz, 2012). To address this shortcoming, Matt Kritz (2012) developed a valid, cost-effective, and time-efficient prognostic tool which is the Movement Competency Screen (MCS). MCS uses general and complex movement tasks observed in activities of daily living, strength, and sport training. The MCS movement tasks recommend a bodyweight load to assess an individual's squat, forward lunge, trunk rotation, upper body push, trunk flexion, upper body pull, and single leg movement competency. MCS is based on the subjective assessment of the aforementioned movement tasks using a standard 2D recording device. Earlier research showed 12

Intrarater and 58 interrater reliability from videos of three athletes pointing to kappa = .93 and r = .79 respectively (Kritz, 2012). Trunk MCS score has been identified as a predictor of injury for male and female national athletes. Also, lower body MCS score served as a modest predictor of lower body injury in female athletes.

Interrater and intrarater test reliability plays a critical role in test promotion and utility. Researchers suggest that reliability can be established in absolute and relative ways (Bruton, Conway, & Holgate, 2000). Absolute reliability is the variation of repeated measurements for individuals. On the other hand, relative reliability refers to manner where individuals maintain their position in a sample over repeated measurements. With the infancy of MCS, there seems to be a lack in the existing literature concerning tester reliability in MCS. Thus, the purpose of this study was to identify the interrater and intrarater absolute and relative reliability of MCS.

METHODOLOGY

Participants

MCS data were acquired from 9 males and 6 females from a national dragonboat team who volunteered to participate in the study. Informed consent was obtained from the participants. The methodology and procedures in this study conformed to the Declaration of Helsinki for human experimentation.

Procedures

MCS data recording was administered at a strength and conditioning facility between 1000-1200 hours. Upon arrival at the facility, the participants performed a standardized warm-up (lunge and reach, reverse lunge and twist, leg swing to toe touch, knee hug to quad stretch) for 2 sets at 5 repetitions per limb by a 2-minute rest. After the rest was completed, the athlete performed the MCS. Two frontal view repetitions and two sagittal view repetitions were administered for each MCS movement task. For lunge and twist and single-leg squat, the screener ensured the lead leg was closest to the video recorder. Squat, lunge and twist, push-up, bend and pull, and single-leg squat were performed in order.

Two raters were involved in the study. The first rater is considered an expert in the field of strength and conditioning and human movement. He is a certified strength and conditioning specialist who holds a doctoral degree and has over 20 years of professional experience in elite sport as a strength and conditioning specialist. The second rater is a certified strength and conditioning specialist with a master's degree in applied sport and exercise science. Movement tasks were based on guidelines presented in Table 1. Each task consists of primary and secondary areas. A rater notes any violation in these areas and assigns a corresponding load level ranging from 1 to 3 using the MCS scoring rubric (Figure 1). For single leg squat and lunge and twist, scoring was assigned on the basis of the weaker limb. Summation of movement tasks makes up the MCS score. Rater 1 rescored the videos a second time after 6 days and rater 2 re-scored after 7 days.

Statistical Analyses

A reliability tool developed by Hopkins (2012) was used to compute intra class correlation coefficient, 95% confidence limit (95% CI) and typical error (TE). Log transformed data was used to derive typical error as percentage of coefficient of variation (%CV). Smallest worthwhile change (SWC) was computed at 0.25 × between-participant standard deviation (Hopkins, Hawley, & Burke, 1999).

RESULTS

MCS scores of rater 1 and rater 2 are displayed in Table 1. During Day 1 interrater ICC was 0.43, 95% CI (-0.08, 0.76). TE was .77, %CV = 1.80, and SWC was 0.63. ICC was 0.56, 95% CI ranged from 0.09 - 0.83, TE = 0.69, %CV = 1.50, and SWC = 0.53 for Day 2. For rater 1, ICC = 0.98, 95% CI (0.93, 0.99), TE = 0.17, %CV = 0.50, and SWC = 0.18. For rater 2 ICC = .76, 95%CI (0.42, 0.91), TE = 0.52, %CV = 0.60, SWC = 0.23.

MCS SCREENING CRITERIA – This is what you should see…if you don't mark the region on the screening sheet.

PATTERN	HEAD	SHOULDERS / T-SPINE	LUMBAR	HIPS	KNEES	ANKLES	FEET	BALANCE	DEPTH
POSTURE	CENTERED	Held back and down with slight flexion	Slight extension	Aligned	Aligned	Aligned	Aligned	NA	NA
SQUAT	CENTERED	Down away from the ears / slightly extended. Elbows held behind the ears during the squat	NEUTRAL	Movement starts here, aligned and extension is obvious	Stable, aligned with the hips and feet	Aligned with the knees and hips	In contact with the ground and stable	NA	Thighs parallel with the ground
LUNGE & TWIST	CENTERED	Shoulders held down and away from ears Rotation occurs here	NEUTRAL, resisting rotation	Horizontally aligned, resisting rotation	Aligned with the hips and feet	Aligned with the knee	Heel of lead leg in contact with the floor, trail foot flexed and balanced on forefoot	Maintained for each leg	Lead thigh parallel with the ground
PUSH UP	CENTERED	Held down away from the ears, scapulae moving in a balanced and rhythmic motion	NEUTRAL	Aligned	Aligned	Aligned	Aligned	NA	Chest touches the floor
BEND & PULL	CENTERED	Held down away from the ears, scapulae moving in a balanced and rhythmic motion during pull	NEUTRAL no bending	Bend occurs here	Aligned and slightly bent	Aligned	Aligned	NA	Trunk parallel with the ground
SINGLE LEG SQUAT	CENTERED	Down away from the ears / slightly extended	NEUTRAL	Movement starts here, aligned and extension is obvious	Stable, aligned with the hips and feet	Aligned with the knee and hip	In contact with the ground and stable	Maintained for each leg	Thigh parallel with the ground

Table 1. **MCS Scoring Criteria**

DISCUSSION

The purpose of this study was to identify the interrater and intrarater absolute and relative reliabilities of MCS. For absolute reliability, the researchers utilize %CV and SWC. A CV of less than 10% presents a good reliability (Cormack, Newton, McGuigan, & Doyle, 2008; Atkinson & Neville, 1998). With this in mind, interrater and intrarater absolute reliability for MCS demonstrated good reliability. However, to determine the test practicality in performance settings, SWC was suggested (Pyne, 2003). If the typical error of a test is less than the SWC, then the test is rated as "good." If a typical error is greater than SWC, this would mean "marginal" test practicality. When SWC was used, MCS presented an interrater marginal usefulness for both days. Rater 1 demonstrated a good MCS test variability. On the other hand, rater 2 posted marginal usefulness. For relative reliability, ICC was used as a criterion. Researchers suggest a clinical significance of ICC below 50 as poor, moderate for .50 -.75, and good for .75 and above (Portney & Watkins, 2009). Interrater ICC was poor for Day 1 but improved to moderate value in Day 2. Intrarater relative reliability for both raters was high.

Technological and biological errors contribute to issues in test reliability (Gore, 2000). MCS scoring disagreement in this study

MCS

MOVEMENT COMPETENCY SCREEN

HOW AN ATHLETE PRODUCES POWER IS MORE IMPORTANT THAN THE POWER THEY PRODUCE

Athlete **Sport** **Date** **MCS Score**

SCREENING INSTRUCTIONS: Based on the MCS criteria mark the PRIMARY or SECONDARY area that is of concern when observing the athlete perform the MCS movement patterns.

Athlete **Sport** **Date** **MCS Score**

SCREENING INSTRUCTIONS: Based on the MCS criteria mark the PRIMARY or SECONDARY area that is of concern when observing the athlete perform the MCS movement patterns.

PATTERN	PRIMARY	SECONDARY	LOAD LEVEL	COMMENTS
SQUAT	o SHOULDERS o LUMBAR o HIPS o KNEES	o HEAD o ANKLES/FEET o DEPTH o BALANCE	1 2 3	
LUNGE & TWIST	o SHOULDERS o LUMBAR o HIPS o KNEES	o HEAD o ANKLES/FEET o DEPTH o BALANCE	1 2 3	
BEND & PULL	o SHOULDERS o LUMBAR o HIPS o KNEES	o HEAD o ANKLES/FEET o DEPTH o BALANCE	1 2 3	
PUSH UP	o SHOULDERS o LUMBAR o HIPS o KNEES	o HEAD o ANKLES/FEET o DEPTH o BALANCE	1 2 3	
SINGLE LEG SQUAT	o SHOULDERS o LUMBAR o HIPS o KNEES	o HEAD o ANKLES/FEET o DEPTH o BALANCE	1 2 3	

SCORING INSTRUCTIONS

Load Level	PRIMARY SECONDARY	Considerations
1	2+ and / or 4	The numbers in the PRIMARY and SECONDARY columns depict the number of areas that were marked during the screen. Select the 1, 2 or 3 in the Load Level column after adding up the checked areas for each pattern.
2	1 and /or 0-3	
3	0 and /or 0-2	

SCORING

GOOD	MODERATE	POOR
13-15	9-12	5-8

Figure 1. **MCS Scoring Sheet**

was mostly related to depth judgments within the MCS tasks. Furthermore, origin of twist and knee motion in the lunge and twist pattern were also noted. A recognized limitation of the current study is that only 2 individual raters were used to score 15 MCS videos. Such number does not reflect the population of MCS practitioners. A more diverse cohort of raters will apparently improve the applicability of MCS. Another suggestion is the monitoring MCS scoring completion time, which may provide more useful information in scoring fatigue. Lastly, a formal test scoring session may help reduce scoring discrepancies.

Movement competency screening may be used to provide insight into why athletes succeed and may also offer a mechanical rationale as to why certain athletes report increased rates of injury (Bartlett, Wheat, & Robins, 2007; Hewett, Lindenfeld, Riccobene, & Noyes, 1999). Important information may be gained simply by observing an athletes' kinesthetic awareness during the performance of the MCS movement tasks. The MCS may provide sport and health professionals with a method for better understanding an athlete's movement ability and their awareness of what constitutes good movement competency. This information may prove valuable prior to exercise prescription for the purpose of assisting how well a sport training program accommodates an athlete's movement ability and that their training adaptation contributes more to performance than the mechanisms of injury. In conclusion, the findings of the study showed a good interrater absolute reliability for both rating days. Interrater relative reliability was poor for Day 1 but was good in Day 2. For intrarater reliability, rater 1 showed good absolute and relative reliability. Rater 2 demonstrated good absolute reliability and high relative reliability.

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APPENDICES