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Reliability and Usefulness of an Eye - Foot Reaction Time Test in Female University Basketball Athletes

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The purpose of this study was to determine the intra- and interset absolute and relative reliability of an eye-foot reaction time test. It also aimed to establish test usefulness. Nineteen (19) university female basketball athletes participated in the study. They performed a standardized warm-up and 2 sets of eye-foot reaction time test on both limbs with each set consisting of 3 trials randomly interspersed within 30 seconds. Intra- and interset interval was set at 15 seconds. Typical error (TE), typical error as percentage of coefficient of variation (%CV), intraclass correlation coefficient (ICC), and smallest worthwhile change (SWC) were computed. For set 1, right foot showed TE = .037, %CV = 8.90, ICC = 0.45, and SWC = .009. Left foot posted TE = .035, %CV = 8.90, ICC = 0.56, and SWC = .010. For set 2, right foot TE = .021, %CV = 8.90, ICC = 0.74, and SWC = .008. Left foot demonstrated TE = .024, %CV = 6.40, and SWC = .008. For interset values, it was seen that right foot showed TE = .010, %CV = 2.60, ICC = 0.93, and SWC = .007. Left foot showed TE = .026, %CV = 6.60, ICC = 0.60, and SWC = .008.

In conclusion, right foot and left foot intraset absolute reliabilities were “good” for set 1 and set 2. However, relative reliability was “poor” for both limbs at both sets. Similarly, test usefulness was marginal for right foot and left foot at set 1 and set 2. In contrast, interset absolute reliability was “good” for the right foot and left foot. Relative reliability was “good” for the right leg but “poor” for the left leg. Eye-foot reaction time test is somehow reliable for the right leg but marginal for the left leg.

Keywords: Eye-Foot Reaction Time, Reliability, Chronojump-Boscosystem, Open Source Technology

INTRODUCTION

In the recent decade, there has been an increasing interest in the application of open source technology for sports performance and monitoring. One such technology is the Chronojump-Boscosystem. The Chronojump-Boscosystem consists of an open source hardware and free software which is compatible with various contact mechanisms that can be used to detect time-based performances (Blas, Padullés, López del Amo, & Guerra-Balic, 2012). One test that can be applied using this technology is the simple Eye-Foot Reaction Time (EF-RT) Test. The EF-RT represents the interval time between the application of visual stimulus and foot contact of a participant. The EF-RT has been related to nervous system insensitivity in brain traumatic injury patients (Gould, Ciuffreda, Yadav, Thiagarajan, & Arthur, 2013). In another light, researchers were able to differentiate the level of athletic competency in football players from EF-RT (Montés-Micó, Buno, Candel, & Pons, 2000). An initial study by Pagaduan (2014) showed good absolute reliability for the left foot and right foot EF-RT in male and female university physical education students. Furthermore, relative reliability was poor for the right leg and good for the left leg. Both feet displayed marginal utility. The purpose of this study was to determine the intra- and intersession absolute and relative reliability of EF-RT in female basketball athletes. This study also aimed to identify the usefulness of EF-RT Test using the Chronojump-Boscosystem.

METHOD

Participants

Nineteen female university basketball athletes during the off-season training phase participated in the study. These athletes have no known orthopedic injury that may prevent them from performing the task. Informed consent was acquired from the participants prior to further experimentation. The procedures of the study agreed with the declaration of Helsinki for Human Testing.

Procedures

This study occurred for a single session between 0600–0800 hours in the

basketball court of a university gymnasium. Upon arrival at the facility, the participants performed the Movement Competency Screen (MCS) exercises for 2 sets. The MCS consists of 5 exercises (squat, lunge and twist, push-up, bend and pull, single leg squat) executed for 2 repetitions in the frontal and sagittal planes. Frontal plane movements are completed first before proceeding to sagittal plane exercises. After MCS, the participants rested for 2 minutes. This was followed by 2 sets of EF-RT Test in the right and left limbs performed alternately. Each set consists of 3 randomized trials interspersed within 30 seconds. Additional trials were performed if any error (technical or erroneous performance by respondents) was perceived by the tester. Intra- and interset rest interval was 15 seconds. The EF-RT was measured using the Chronojump-Boscosystem. In this study, a visual stimulus (5-mm green LED light), push button, and two parallel contact platforms (30.48 cm $\times$ 30.48 cm) were connected to chronopic set at 10 ms. The chronopic is linked to the Chronojump-Boscosystem software which displays time results. The height of the LED is set at 150 cm. Contact platforms are 150 cm away from the light stimulus and are separated by 30.48 cm with 5.08 cm and 10.16 cm markings placed away from the platforms.

In the EF-RT Test, athletes were positioned at the center of the light stimulus and stood at hip width apart with hands hanging at the sides. The lead foot and trail foot were placed at 5.08 cm and 10.16 cm markings, respectively. Markings were referenced at the edge of the contact platforms. Athletes were encouraged to keep both feet on the ground. Upon seeing the green light initiated by the release of the push button by the tester, the athletes step on the platform as quickly as possible using the lead leg.

Analysis

Intrasets and intersets data were presented as mean $\pm$ standard deviation. All the trials in each set for both limbs were used for intrasets analyses. The mean of each set for both limbs was subjected to intersets analyses. Absolute reliability was determined using percentage of coefficient of variation (%CV) derived from the log transformed data. Relative reliability was identified from intraclass correlation coefficient. Test usefulness was established comparing typical error (TE) with smallest worthwhile change ($0.2 \times$ between-subject standard deviation). Analyses were performed using a reliability MS excel file developed by Hopkins (2000a).

RESULTS

Table 1 shows the intraset reliability and usefulness of left and right EF-RT. Right foot — set 1 depicted TE = .037, %CV = 8.90, ICC = 0.45, and SWC = .009. Set 1 of the left foot demonstrated TE = .035, %CV = 8.90, ICC = 0.56, and SWC = .010. In the second set of the right foot, TE was .021 with %CV = 8.90, ICC = 0.74, and SWC = .008. The second set of the left foot posted TE = .024, %CV = 6.40, ICC = 0.69, and SWC = .008.

Table 1. Intra-Set Typical Error, %CV, ICC and SWC of Right and Left EF RT

Set 1	1	2	3	TE	%CV	ICC	SWC
Right	.391 ± .038	.400 ± .060	.390 ± .036	.037	8.90	0.45	.009
Left	.415 ± .050	.394 ± .054	.388 ± .052	.035	8.90	0.56	.010
Set 2	1	2	3	TE	%CV	ICC	SWC
	.377 ± .043	.377 ± .035	.387 ± .039	.021	8.90	0.74	.008
	.384 ± .043	.384 ± .043	.377 ± .041	.024	6.40	0.69	.008

Table 2. Interset TE, %CV, ICC and SWC of Right and Left EF RT

	Set 1	Set 2	TE	%CV	ICC	SWC
Right	.393 ± .036	.380 ± .034	.010	2.60	0.93	.007
Left	.399 ± .041	.382 ± .037	.026	6.60	0.60	.008

For interset variables, EF-RT of the right foot showed TE = .010, %CV = 2.60, ICC = 0.93, and SWC = .007. On the other hand, left foot EF-RT demonstrated TE of .026, %CV = 6.60, ICC = 0.60, and SWC = .008.

DISCUSSION

The main objective of this study was to identify the intra- and interset reliability of right and left EF-RT Test in Chronojump-Boscosystem. Absolute reliability was interpreted as “good” if %CV is less than 10% (Atkinson, Neville, & Edwards, 1999). Relative reliability is “good” if ICC is at least 0.90 (Hopkins, 2000b). For test usefulness, TE was compared with SWC (Hopkins, 2004). A test is considered to have high usefulness if TE is less than SWC. If TE is equivalent to SWC, a test is somewhat useful. If TE is greater than SWC, a test has marginal utility. In this study, results

revealed that intraset absolute reliability was “good” for both limbs in both sets. However, intraset relative reliability posted “poor” values for right and left EF-RT in both sets. Additionally, EF-RT Test using intraset values was nonuseful. It should also be noted that an increasing trend intraset absolute and relative reliability existed from set 1 to set 2 of right and left leg.

For interset values, it was identified that right leg EF-RT presented “good” absolute and relative reliability. The SWC was almost the same as TE which means that using right EF-RT Test is somehow useful. Absolute reliability for the left leg was “good” but relative reliability was “poor”. The EF-RT Test for the left leg is marginal.

Utilizing EF-RT in Chronojump-Boscosystem may provide a low-cost alternative among practitioners. Implications for increasing EF-RT reliability include additional number of sets and intraset trials. In conclusion, intraset absolute reliability for right and left EF-RT Test was “good” while relative reliability was “poor” for set 1 and set 2. Intraset EF-RT Test usefulness was marginal for both limbs. Interset absolute reliability was “good” for right and left EF-RT Test. Relative reliability was “good” for right EF-RT Test but was “poor” for left EF-RT Test. Right EF-RT Test was useful while left EF-RT Test has marginal usefulness.

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