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Original article

THE RELATIONSHIP BETWEEN FUNCTIONAL MOVEMENT SCREEN AND SWIMMING PERFORMANCE

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Abstract

Aim. The aim of the study was to determine the relationship between FMS and swimming performance.

Methods. Ninety three swimmers (43 females, 50 males; 11,48 ± 0,50 years aged, 1,56 ± 0,11 m. height, 46,2 ± 9,83 kg body weight) were participated to the study. Deep squat, hurdle step, inline lunge, shoulder mobility, active straight leg raise, trunk stability push-up, rotary stability measurements were determined in FMS testing and total scores were calculated in accordance with the literature. 200 m Individual Medley swimmingperformances of the swimmers were measured in a 25 m swimming pool.

Results. As a result of this study no significant relation was seen between FMS and swimming performance except activestraight leg raise and rotary stability for both gender.

Conclusion. In the present study no significant relation was seen between FMS total scores and swimming performance for both gender. FMS test batteries still valuable in evaluating and following the risk of injury in swimming during training season

Keywords: Movement Screen, Swimming Performance, Injury Risk, Athletic Performance

Introduction

Functional Movement Screen (FMS) is a test battery that is used to determine joint mobilization and stabilization of individuals with 7 different motion patterns (Orr et al., 2016). FMS battery has a a high inter-rater and and intra-rater reliability (Teyhen et al., 2012; Gribble et al., 2013).

Recently FMS tests have begun to be used as a preliminary test for both the performance of the athlete and for protection from injuries (Martin et al., 2016).

Beside the high correlation between FMS scores and disability risks some studies also declared close relations about FMS in determining the physical performance and individual limitations to movement of persons (Chorba et al., 2010; Martin et al., 2016).

Considering the limited number of performance related study results, FMS scores had no significant correlation with some athletic performance components such as 10m, 20m sprints, vertical jump and some spesific movement patterns related to the sports(Parchmann and McBride, 2011).

On the other hand, in their study Okada et al. (Okada et al., 2011) reported some significant corelations between FMS components and some movement patterns such as single-leg squat, throwing medical ball backwards and T-run agility test. Nevertheless, there is no study on swimming performance and FMS relationship in the literature.

Swimming is a populer branch that is influenced by many physiological, hydrodynamic and biomechanical factors, and which is highly correlated with some anthropometric features (Christensen and Smith, 1987; Okada et al., 2011). Particularly during pre- and early adolescence, swimming performance is determined by the ROM depended movement quality and economy of energy which are more dominant than muscle mass and energy metabolism (Lätt et al., 2009). The excellence and sustainability of biomechanical repetitions in swimming is an important factor in determining performance.

Especially in short course pools, it is stated that reaching high swim speeds are related to the number of turns.

The individual medley competitions are consist of almost all specific forms of movements in swimming. The parameters affecting gender-specific performance also differ in these races (Morais et al., 2013).

Metabolic and physiologically lower lactate concentrations and heart rate responses are seen in short course swimming competitions (Wolfrum et al., 2014). In this case, the importance of the technical excellence and biomechanical parameters may be more important in short course competitions.

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FMS scores can be evaluated as a good indicator of functional mobility, mobility and stability. FMS scores can be a marker for determining swimming performance in this direction.

The purpose of this study was to evaluate the relationship between short course competitions and FMS scores and the effect of gender differences in individual mixed swimming players of 11-12 year old competitors.

Methods

Subjects

Ninety-three swimmers (43 female, aged 11,5 ± 0,5 years and 50 male aged 11,5 ± 0,5 years) participated in this study. Participants were selected from the Olympic Swimmer Development Camp organized by the National Federation of Swimming. Swimmers were training regularly and did not experience any injury during the season.

The swimming performances of 200m medley were performed in the short course swimming pools. The average swimming times were 166,38 sec.+/-6,62 for female (73,4% of world record) and 169,04+/-6,11 seconds for male(65,4% of world record). This study was approved by the ethical committee of Dokuz Eylül University.

Procedures

Testing was conducted in the end of the competitive season. Volunteers were informed about the procedures before the study. Written and verbal consent were obtained from both participants and their parents.

Participants' FMS scores, body lengths, body weights, and body mass indexes were measured. The best swimming times of 200m individual medley in the short course swimming pool in the official competitions were considered to evaluate the relationship with FMS scores.

Application of the Functional Movement Screen

FMS The tests consist of the hurdle step, deep squat, in-line lunge, shoulder mobility, active straight leg raise, rotary stability and stability push up. Test scores ranged from 0-3 for each test with the highest total composite score being 21 (Garrison *et al.*, 2015).

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All participants completed the seven tests of the FMS. In five of the seven tests, considering the asymmetry between right and left side, lowest scores were recorded (Garrison et al., 2015). In addition, participants were informed about the observed asymmetry conditions.

Scores were rated as follows: "0" point if it was pain in movement, "1" point if unable to complete the task, "2" points to complete the task with difficulty or help, "3" points to complete the task in a relaxed and wide range.

All movements were repeated 3 times and the best score was recorded(Schneiders et al., 2011; Cook G., 2012; Wolfrum et al., 2014). Fourteen and lower points of a total of 14 points were considered as the risk of injury (O'connor et al., 2011; Wright et al., 2015).

Materials

The FMS™ kit (Functional Movement Systems, Chatham, VA) is a pre-constructed apparatus utilized for completing the FMS™. The contents of this kit include a two inch by six inch board, three dowels (i.e., two short dowels and one four-foot long dowel), and an elastic cord which is assembled to evaluate seven different movement patterns without a warm up (Cook G., 2012). Also Seca™ Measuring Equipment was used to measure body weight and height.

Statistical Analysis

All parametres were described as mean (± standart deviation). The relationship between swimming time and FMS scores was determined evaluated by using the Pearson's correlation. Gender difference was compared by independent samples t- test. The alpha level was set at $p<0.05$.

Results

The physical characteristics and swimming performance of the female and male swimmers were shown in Table I.

Gender differences of FMS Parameters and Total Score values were compared in Table II. The correlation between FMS Parameters and Total Score values of Female swimmers were shown in Table III.

The correlation between FMS Parameters and Total Score values of male swimmers were shown in Table IV.

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Table 1.Physical Characteristics And Swimming Performance Of Swimmers

	Female ***Mean ± Sd***	**Male** ***Mean ± Sd***	**P**
Age *(year)*	11,48 ± 0,50	11,47 ± 0,50	,905
Height*(m)*	1,54 ± 0,57	1,56 ± 0,11	,477
Body Weight *(kg)*	43,8 ± 6,13	46,2 ± 9,83	,158
Body Mass Indeks *(kg/m2)*	18,29 ± 1,89	18,79 ± 2,14	,243
Swimming time (sec)	166,38±6,62	169,04± 6,11	0,06

Table 2. FMS Test Scores Of Swimmers

	Female Mean ± Sd	**Male Mean ± Sd**	**P**
Deep squat	2,59 ± 0,49	2,47 ± 0,731	0,684
Hurdle step	2,12 ± 0,63	1,93 ± 0,624	0,147
Inline lunge	2,12 ± 0,66	1,93 ± 0,759	0,205
Active Straight Leg Raise	**2,93 ± 0,24**	**2,43 ± 0,974**	**0,001(*)**
Trunk Stability push up	2,87 ± 0,33	2,86 ± 0,347	0,842
Rotary Stability	**2,42 ± 0,57**	**2,13 ± 0,667**	**0,034(*)**
Shoulder Mobility	2,61 ± 0,53	2,36 ± 0,780	0,136
Total Score	**17,71 ± 1,65**	**16,13 ± 2,318**	**0,000(*)**

p<0,05

Table 3. Correlation between FMS Total Scores and Swimming Time of female swimmers

		Total Score	Swimming time
total_score	Pearson Correlation	1	.022
	Sig. (2-tailed)		.892
	N	43	40
Swimming time	Pearson Correlation	.022	1
	Sig. (2-tailed)	.892	
	N	43	43

Table 4. Correlation between FMS Total Scores and Swimming Time of maleswimmer

		Total Score	Swimming Time
total_score	Pearson Correlation	1	.014
	Sig. (2-tailed)		.923
	N	49	49
Swimming time	Pearson Correlation	.014	1
	Sig. (2-tailed)	.923	
	N	50	50

Discussion

There were no significant differences of between males and females in physical characteristics and Swimming Time. In another study conducted in similar age groups they did not find a significant difference in swimming time between gender (Barbosa *et al.*, 2015). In that age, it is considered that both genders have similar anthropometric values in terms of growth and development, reflecting similar to swimming performance values.

However, the Active Leg rise, Rotary stability and FMS scores of females were significantly higher than those of males ($P<0.05$) (Table 2). Bullock et al also reported similar differences in Active Leg rise and Rotary stability of swimmers (Bullock Spt et al., 2016). Besides, some studies on young populations also reported that female had a higher total score than male (Schneiders et al., 2011). In this study, it was observed that the female group had more obvious differences in the movements requiring balance and flexibility within the FMS movement patterns. However, the scores from movements required core strength were similar in both gender. This situation caused female to have higher scores.

There was no significant correlation between FMS total score and 200m swimming performance in both female and male swimmers.

The relationship between FMSscores and athletic performance has been investigated in athletic performance, some sports such as golf, track and field etc. (Okada et al., 2011; Parchmann and McBride, 2011).

Conclusions

Present study aimed to investigate relationship between FMS and swimming performance. FMS is valuable in detecting joint mobility, assimetry, flexibility and such properties are should be important for biomechanics of swimming.

Particularly, joint range of motion is essential in performing the ideal technical forms in swimming. However, although FMS has valuabe measures for swimming, no significant relation was seen between FMS and swimming performance for both gender in the present study.

It seems that FMS is not suitable in assessing swimming performance. Neverthless, new testing batteries including motion ranges of joint and biomechanical parameters for swimming should be improved to assess and monitor the swimming performance for swimmers. FMS still remain valuable in evaluating and following the risk of injury in swimming during training season.

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