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Relationship between Functional Movement Screen™ (FMS™) and physical test by gender in the healthy adults

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Background

To prevent sports injuries

- Etiology
- mechanism

Physical function and performance screening

Functional approach based on fundamental movement patterns

Physical function and performance screening

Functional Movement Screen™ (FMS™)

Gray Cook et al. (2006)

The elements of FMS™

- **a useful tool for assessing performance deficits or risk of injury**
- **outcomes tool to determine effectiveness of exercise interventions**

FMS™

- The 7 fundamental movement patterns
- Scored 0 (lowest) through 3 (highest)
- The lowest score from the three trials
- Best possible score = 21 points

7 movement patterns of FMS™

1. Deep Squat
2. Hurdle Step
3. Inline Lunge
4. Shoulder Mobility
5. Active Straight-Leg Raise
6. Trunk Stability Push Up
7. Rotary Stability

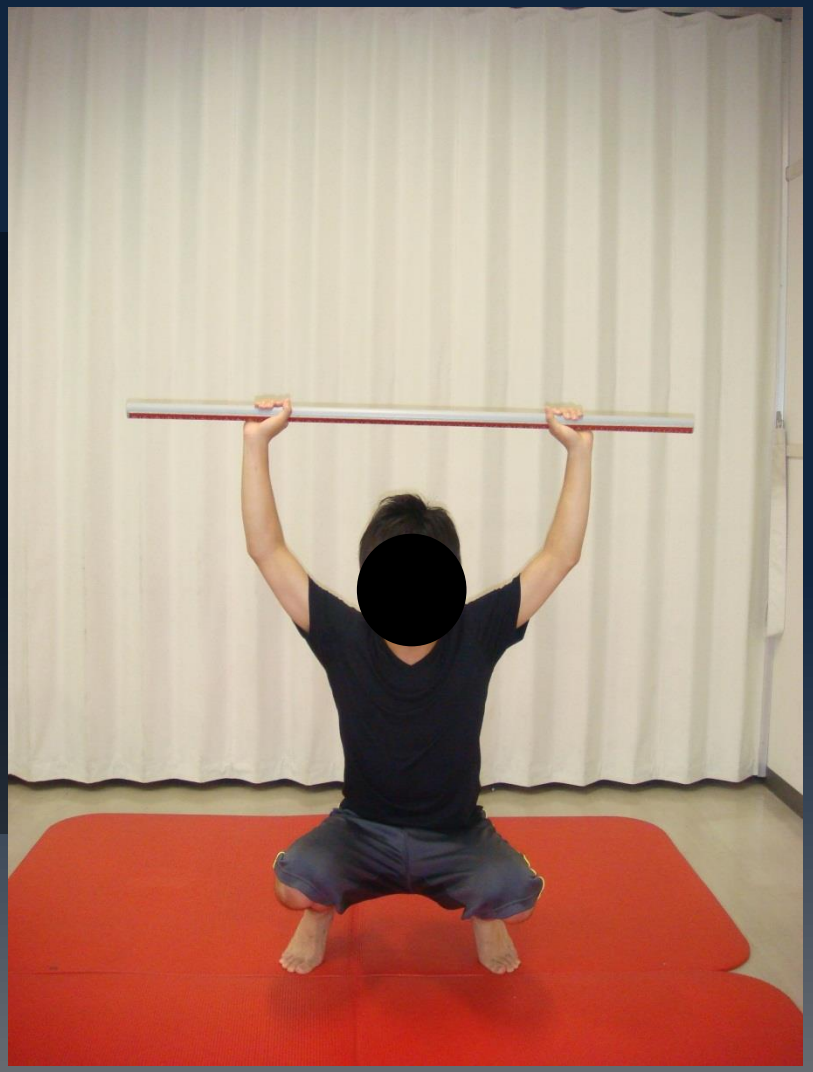
Scoring of FMS™

- 3 points
  Perform the functional movement pattern
- 2 points
  Able to complete movement pattern with compensation
- 1 points
  Unable to perform the movement pattern.
- 0 points
  Pain associated with any portion during the test

7 movement patterns of FMS™

1. Deep Squat

- Trunk is parallel with tibia toward vertical
- Femur below horizontal
- Knees aligned over feet
- Dowel aligned over feet

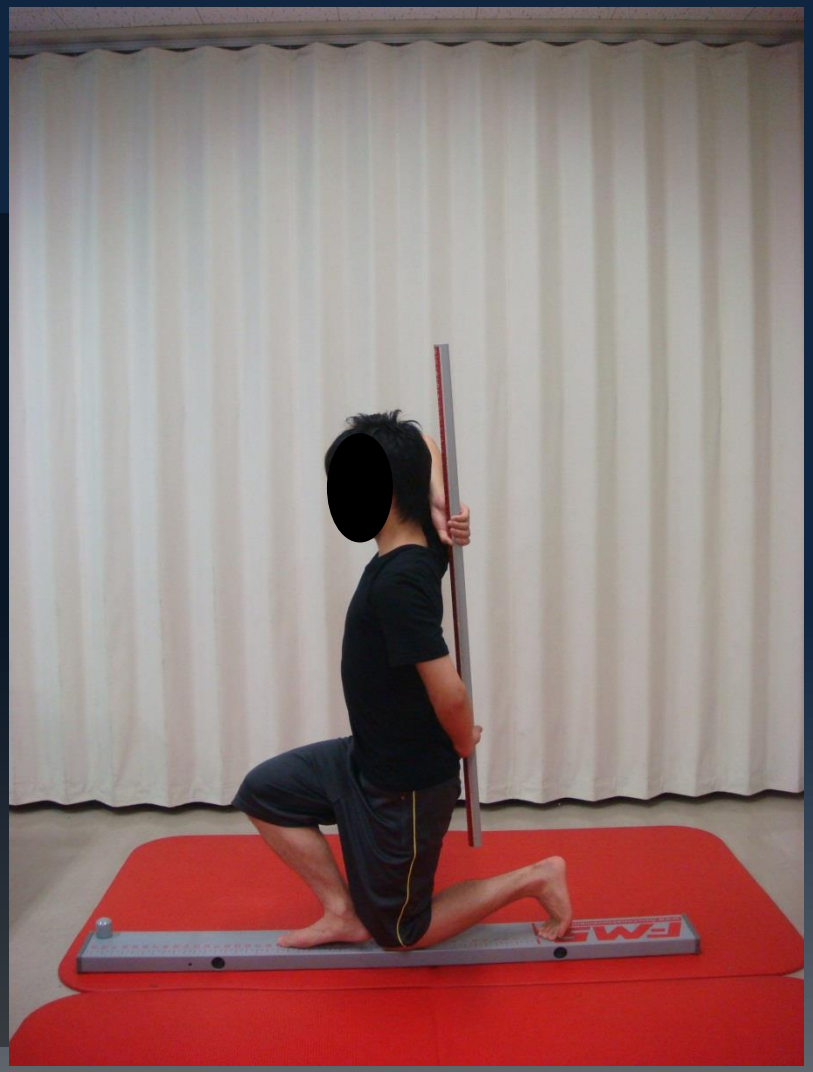


2. Hurdle Step

- Dowel and hurdle remain parallel
- Hips, knees and ankles remain aligned in the sagittal plane
- Minimal to no movement is noted in lumbar spine

3. Inline Lunge

- Dowel contacts maintained
- Dowel remains vertical
- No torso movement noted
- Knee touches board behind heel of front foot
- Dowel and feet remain in sagittal plane



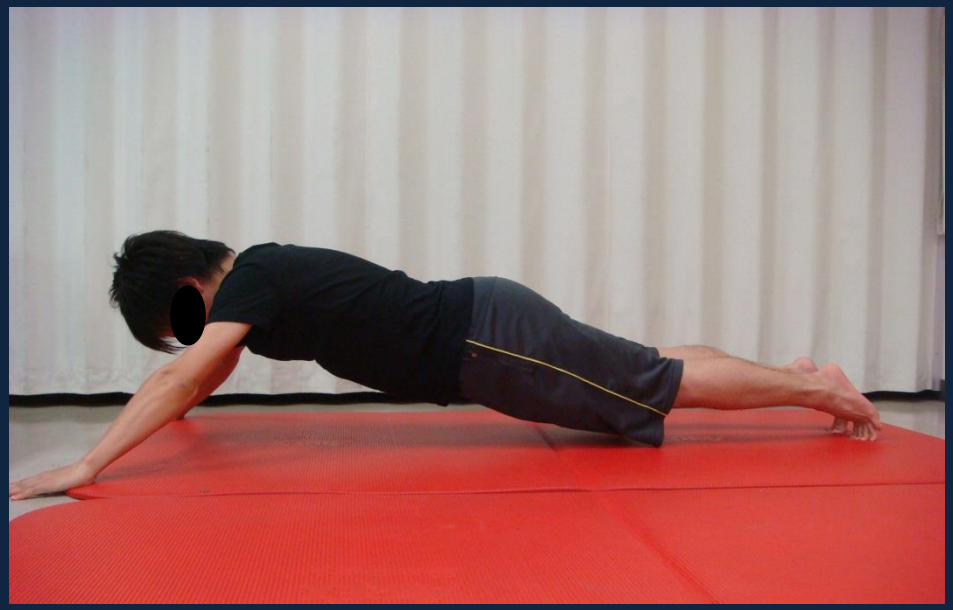
4. Shoulder Mobility

3. Fists are within one hand length
2. Fists are within one and a half hand lengths
1. Fists are not within one and half hand lengths

5. Active Straight-Leg Raise

- Vertical line of the malleolus resides between mid- thigh and ASIS
- The non- moving limb remains in neutral position

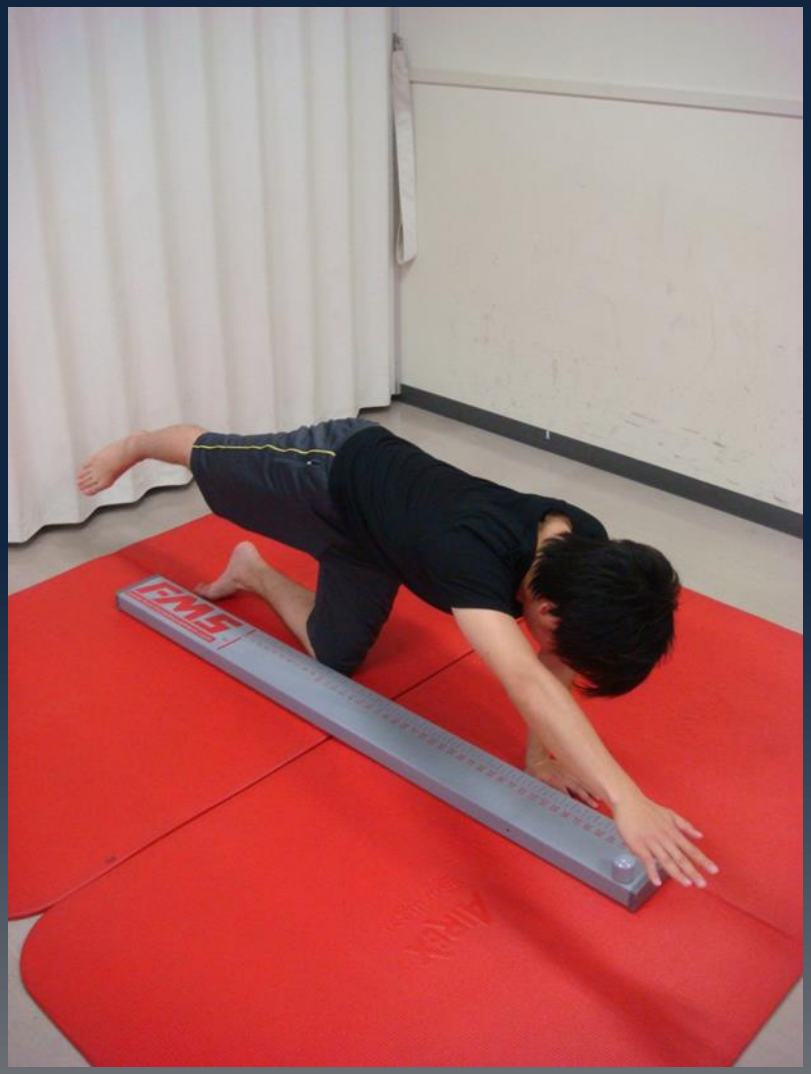
6. Trunk Stability Push Up



- The body lifts as a unit with no lag in the spine
- Men perform a repetition with thumbs aligned with the top of the head
- Women perform a repetition with thumbs aligned with the chin

7. Rotary Stability

3. Perform a correct unilateral repetition
2. Perform a correct diagonal repetition
1. Inability to perform a diagonal repetition



Evidence of FMS™

- Reliability for FMS™

- High expert and novice examiner within-subject between reliability due to video analysis.
(Minick et al., 2010)

- In the Athletic Trainner (AT) students and AT by the video analysis, the examiner in the reliability of the AT with FMS™ experience is low only student.
(Gribble et al., 2012)

- High reliability between the examiner within-subject in the beginners.
(Teyhen et al., 2012)

Evidence of FMS™

- Biomechanics

  - Group of high score of deep squat is significantly larger motion range in each joint and knee extension moment.
    (Butler et al., 2010)

Unclear topic

Relationships between these variables by gender have not been established.

Purpose

To clarify the relationship between FMS™ and physical test by gender.

Hypothesis

FMS™ scores shows the relationship between physical tests in male and female respectively.

Subjects

Table 1. Characteristics of subjects

	Total (n=28)	Male (n=16)	Female (n=12)	p-value
Age (years)	20.9 (1.2)	21.1 (1.5)	20.7 (0.5)	n.s.
Height (cm)	164.6 (9.4)	170.5 (7.5)	156.8 (4.7)	*
Body mass (kg)	56.5 (10.0)	62.4 (8.2)	48.5 (5.6)	*
Body mass index (kg/m^2)	20.7 (0.5)	21.4 (2.0)	19.7 (1.7)	n.s.

Mean (SD) * $p<0.05$ n.s. not significant

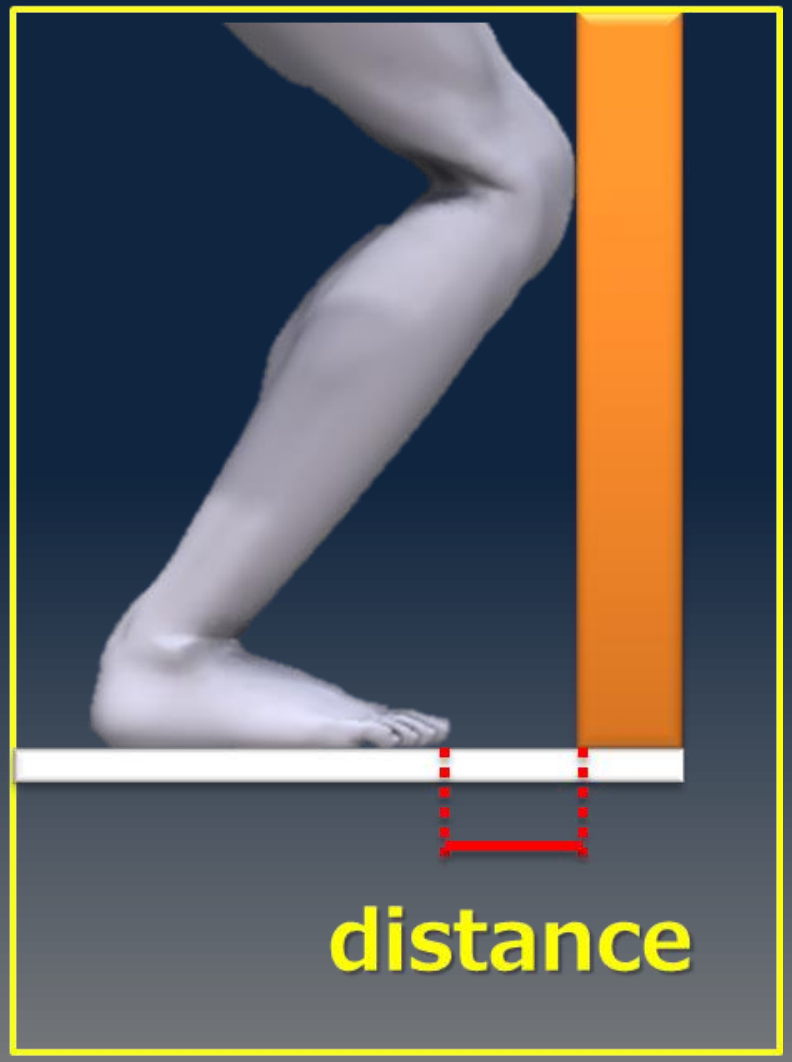
Healthy individuals were defined as those with no incidence of upper or lower extremity injuries within the last 6 months.

Material & Methods

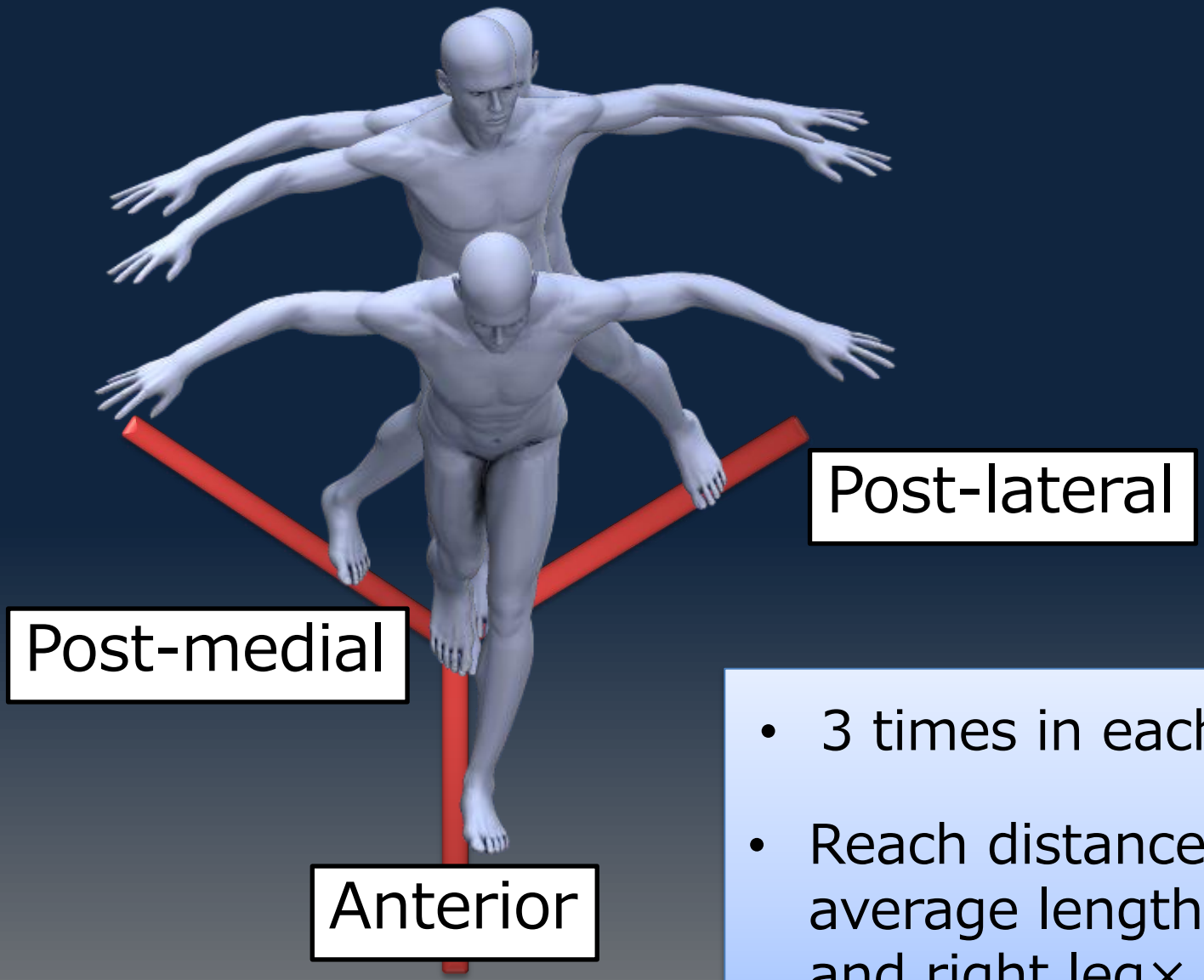
- **Performance test**
  - FMS^{TM}
- **Clinical physical function test**
  - Weight bearing ankle dorsiflexion ROM
  - Non weight bearing ankle dorsiflexion ROM
  - Y-balance test (Y-test)
  - Functional reach (FR)
  - Isometric trunk flexor/extensor
  - Vertical squat jump

Weight bearing ankle dorsiflexion ROM

(Vicenzino et al., 1998)



Y-balance test (Plisky et al., 2009)



- 3 times in each direction
- Reach distance / the average length of the left and right leg× 100%

Isometric trunk muscle (Extensor / Flexor)

Attachment

Isoforce GT-350
(OG Giken Co, Ltd, Japan)

- Maximal voluntary effort
- 3 trials

Statistical analysis

- Comparison of total FMS™ by gender
  → Unpaired t-test
- Compare each item of FMS™ by gender
  → Mann–Whitney U test
- Strength of the relationship between total score of FMS™ and physical test
  → Pearson correlation coefficients
- Statistical significance was set at p less than 0.05

Results

Table 2. FMS™ total score（ Male vs Female ）

	Male	Female	p-value
FMS™ total score	16.2 ± 2.2	15.7 ± 1.4	0.42

Mean ± SD

Table 3. FMS™ each score（ Male vs Female ）

	Male	Female	p-value
SLR (Lt)	2.0 (2.0-2.0)	3.0 (2.8-3.0)	**0.02**
Push up	2.0 (2.0-3.0)	2.0 (2.0-3.0)	**0.04**

Median (IQR)

Table 4. Correlation between FMS™ and physical functional Test

	FMS™	
Variable (Left side)	**Male**	**Female**
Non Weight Bearing Ankle ROM (Lt)	0.35	**0.75** **
Weight Bearing Ankle ROM (Lt)	0.10	0.45
Y-test Posterior-Medial (Lt)	0.07	0.44
Y-test Posterior-Lateral (Lt)	0.25	0.34
Y-test Anterior (Lt)	0.17	0.20

(*:p<0.05, **p<0.01)

Table 5. Correlation between FMS™ and physical functional Test

	FMS™	
Variable (Right side)	**Male**	**Female**
Non Weight Bearing Ankle ROM (Rt)	0.45	**0.69** **
Weight Bearing Ankle ROM (Rt)	0.38	0.50
Y-test Posterior-Medial (Rt)	0.34	0.39
Y-test Posterior-Lateral (Rt)	0.50	0.39
Y-test Anterior (Rt)	0.30	0.25

(*:p<0.05, **p<0.01)

Table 6. Correlation between FMS™ and physical functional Test

	FMS™	
Variable	**Male**	**Female**
Functional Reach / TMD	0.36	0.26
Trunk Flexor/kg	**0.58 ***	0.26
Trunk Extensor/kg	**0.78 ****	0.16
Trunk Muscle Ratio (Flexor /Extensor)	- 0.46	- 0.45
Vertical Squat Jump	0.19	0.43

(*:p<0.05, **p<0.01)

Discussion

FMS^{TM} in total score (Male vs Female)

FMS^{TM} score was no significant among the gender.
(Schneiders et al., 2011 ; Duncan et al., 2012)

⇨ This study supports these research.

FMS^{TM} in each score (Male vs Female)

- SLR : Female ↑
- Push up : Male ↑

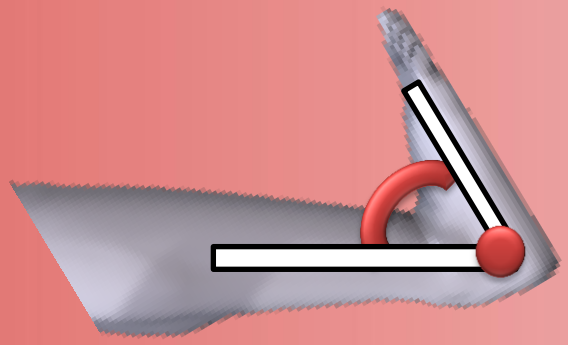
Characteristics in gender
(Schneiders et al., 2011)
(Nesser et al., 2008)

Correlation FMS™ and physical function test

Strength

Female

Flexibility



Conclusion

1. This study aimed to clarify the relationship between FMS™ and physical function test by gender.

2. Total score of FMS™ is non significant by gender. However, SLR and push up of FMS™ are significant difference between male and female.

3. FMS™ score may be correlation with muscle strength in male and with flexibility in female.