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Original Article

Functional movement screening as an assessment in the early childhood

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Abstract:
Functional Movement Screening study arises from the concerns of athletes in maximizing muscle function based on daily activities. While the instrument of assessment in motion functions is based on the assessment of motoric motion functions referred to as functional movement screening (FMS). The purpose of this study is to identify individuals at risk who seek to maintain or increase their level of activity. Moreover, it helps in designing the program by systematically using corrective exercises to normalize or improve the patterns of fundamental movements. The result of this study shows that there are seven instruments that were tested to assess the development of the children's motoric movements. The FMS instruments are as follows: (a) Deep Squat at Chair, (b) Hurdle Step, (c) Lunges, (d) Shoulder Mobility, (e) Active Straight-Leg Raise, (f) Trunk Push, and (g) Rotary stability. The compiled FMS Movements Test can be used in filtering the fundamental movements based on proprioceptive and kinesthetic awareness principles. This research was designed as a case study using a qualitative approach. In this research, the case involved a bounded context and consisted of a preschool group of younger children between 1 and 3 years of age and their preschool teachers. In addition, one thing to be remembered is that motoric learning is not just about the body, joints and muscles, but the main thing is to create synergy, balance, symmetry, and skills during the overall movement patterns. Functional assessment could be incorporated into screening tool and return to sport testing in order to determine whether the early childhood has the essential movements needed to participate in sports physical activities at a level of minimum competency.
Key Words: functional movement, functional movement screening, early childhood

Introduction

Early childhood is the most influential stage in the development of children's movements for the next stages of their life. At this stage, the children should get the chance to explore their world. But the fact that their parents need to work precisely restricts them to play and socialize with their friends. explained that "in that age range the child is still on playing stage" (Harshbarger, Anderson, & Lam, 2018). In addition, early age is a time when the children can explore things by playing, so that the children can develop their motoric skills. explained that "early life has a great potential for developing his motor skills" (Aka, Aktuğ, Altundağ, Şahin, 2019). One of the great potentials that can be developed is to provide easiness in adapting to their environment. stated that "motion of children aged 0-1 is the basis for functional movement." This means that the motion of children aged 0-1 years is the basis for the development of an athlete's motion (Arghadeh, Letafatkar, & Shojaeddin, 2018).

The children's motion behaviour is determined by the teacher in the learning environment. stated that "for a group of pre-school children while moving in need of help from teachers to change the mindset and fighting power of the child to move through the guidance of the teacher is very important". Children's movements and physical activities can prevent the symptoms of injury during the physical activities (Molina-Garcia, Migueles, Cadenas-Sanchez, Esteban-Cornejo, Mora-Gonzalez et al., 2018). A study conducted by stated something related to the motion filtration skills of an athlete (Armstrong, Brogden, Milner, Norris, & Greig, 2018). It was stated that the screening process was performed by using a diagnostic test

As previously researched by, the test instrument of Functional Movement Screening (FMS) can be used as a technique to determine the natural motion of adults. In Indonesia, there has been no research on the making of the test instrument which is based on the early childhood. The children can see the progress of their motoric movement in the future through the Functional Movement Screening (FMS). One example of motion in the FMS is the fundamental movement skills (gross motoric skills), mobility and stability, basic motoric control, and fundamental sport skills (Dyer, Callister, Sanctuary, & Snodgrass, 2019). The Functional Movement Screening research study emerged from the fears of the athletes in maximizing muscle function based on daily activities. The assessment or instrument assessment in motion function is based on the physical opportunities and therapy, but there are other things that becoming important aspects in the assessment of motoric motion function (Attwood, Roberts, Trewartha, England, & Stokes, 2018). Functional Movement Screening or known as FMS is designed to identify the functional and asymmetric movement deficits that may be predicted to occur in musculoskeletal injuries. From this plan, the ultimate goal is to be able to modify the movement deficits that has been identified through the individual exercise prescriptions.

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Another study on Functional Movement Screening was the study stating that the study of the motion association stated that there were 5 variables used in fundamental Movement Screening (FMS), the initial contact (relationship or eye contact), abduction moment, peak knee angle, peak vertical, medial knee displacement contrast study (Dorrel, Long, Shaffer, & Myer, 2018). One of the focuses in the skills of the motion function begins from professionally arranged events, such as those adapted in sports education and specific motor development education (Chang, Chou, Chang, & Chen, 2020).

The process of optimizing the human muscle movement and nerve function can be used as an indication of the development of motion assessment for the children (Regaieg, Kermarrec, & Sahli, 2020). The Functional Movement Screening consists of mobility (human movement tendency), stability and proprioception (motion awareness). Mobility is the range of motion, while stability is related to the joints in the ankle. Proprioception is a human consciousness that directly responds to motion. The three skills of such motion can also be called Functional Movement Skills (Philp, Blana, Chadwick, Stewart, Stapleton, Major, & Pandyan, 2018). These skills are related to the expected sustainable motion assessment tools. First, regarding the output program. Second, the motion product is better than the motion process. Third, the skill of motion from the motoric ability. Fourth, dynamic system approach. Fifth, non-standard test. Sixth, the technological application in the assessment of motoric movement skills in the future (Triplett, Dorrel, Symonds, Selland, Jensen, Poole, 2021).

The functional motion screen (FMS) is a filtration system that seeks to enable professionals to assess someone's fundamental movement pattern (Conkin, Hinton, Ross, Schram, Pope, & Orr, 2020). This filtration system fills the void between the pre-participation/pre-placement screening and the performance tests by evaluating individuals in dynamic and functional capacities. Such filtration system can also provide essential tools to assist in determining the readiness to re-exercise after completing a rehabilitation after an injury or surgery (Ghasempoor, Alizadeh, Minoonejad, Akoochakian, 2018). Such screening tools can offer different approaches to injury prevention and performance predictions. When used as a part of a comprehensive assessment, the FMS can lead to individual, specific and functional recommendations for physical fitness protocols in an active and athletic population group. The FMS consists of seven fundamental movement patterns (tests) that requires the balance of mobility and stability (including neuromuscular/motor control). The FMS test movement is made to be used in the screening of fundamental movements, based on the principles of proprioceptive and kinesthetics consciousness (Kuzuhara, Shibata, Iguchi, & Uchida, 2018). As a result, this arrangement is an important context for the children to engage in physical activities by providing time in the outdoors that support the development of their fundamental motoric skills. It can be reflected in the interaction with the teachers who facilitate physically-active games that assist the children to reach the recommended level of physical activity (Moore, Chalmers, Milanese, & Fuller, 2019).

Researcher stated that motoric competence and physical activity were established for many years in the early childhood. Early childhood education setting is an important context for the children's involvement in a physically-active game (Scudamore, Stevens, Fuller, Coons, & Morgan, 2018). Research conducted showed findings from online surveys that examine resources, space and costs for physical activity and risk-defining activities of physical activity outside the field within the 245-term ECE centre across Australia. The results of the research provide an insight into how the outdoor playing environment in the early childhood setting is. Apparently, the utilization of the open spaces for early childhood can help and support thoroughly the physical activities, and the continuous risk-taking can be overcome, and how the available space and resources can restrict these opportunities (Shimoura, Nakayama, Tashiro, Hotta, Suzuki, Tasaka, & Aoyama, 2019).

The research studies above have resulted in a data on the outside playing environment at the national level that previously was unavailable. Thus, the result provides an important basis in which the future studies can explore social and environmental factors that affect physically-active games and risk-taking deeper. They stated that the affordability may be useful in identifying certain elements in an environment that facilitates a high level of physical activity. Based on the background above, there are at least some considerations in this paper. First, the absence of instrument screening movement in pre-school children. Second, screening is only for adults but still based on western research or still a few that are researching the topic in Indonesia. Third, motoric motion as the basis for the learning process of the children. Fourth, to know the limitation of the physical development of the children's motoric movement. Fifth, to know the obstacles of physical motoric development even sooner. Sixth, functional basic motion of the children is done daily. From the research considerations, the topic presented in this paper is "Functional Movement Screening as an Assessment in The Early Childhood".

Material & Methods

This research had been designed as a case study. In a case study, the researchers try to understand and interpret a unit in terms of its actors. The case study provides a unique example of actors in real situations and investigates the interactions of those involved. The strength of a case study is that it allows attention to actions taken for granted (Alam, 2020). In this research, the researchers focused on actions that could be done in online teaching-learning process in early childhood class. In this research, the case involved a bounded context and consisted of a preschool group for younger children between 1 and 3 years old and their experienced preschool teachers who have been working (teaching) for several years. The preschool setting is located in an urban area in Jakarta, Indonesia. Data collection was done based on field notes, photos, and videos taken during the learning

process. Field notes were carried out especially in the initial part of the study. The focus during observation was on child-adult interactions during different activities and different times of the day during online teaching-learning process. The aim was to identify if and to which extent preschool teachers had similar ways of engaging in activities during their interactions with children online using Zoom platform. Different situations that had been observed during different days and with different preschool teachers were zoomed in. It enabled researchers to choose between a variety of activities and to do a deep study of some of those. For this article, the researchers chose to observe online teaching-learning activities (Amelia, Hendratno, Jannah, 2019).

Results

Each child's physical or motoric exercise demonstrates a fundamental example of motions that shows various benefits. Some common benefits in the application of Instrument Functional Movement Screening are as follows: (1) identifying the risky individuals who seek to maintain or increase activity levels, (2) assisting in the planning of the program by systematically using corrective exercises to normalize or improve the pattern of fundamental movements, (3) providing the systematic tools to monitor the progression and development of the movement patterns in the presence of injury status changes or the fitness level, (4) creating a baseline of functional movements that will enable the movement of rankings for a statistical observation, and (5) improving the ability to perform certain essential movements. Therefore, the purposes of this clinical commentary (the first of a two-part series) are to describe the first three tests of the FMS and to offer an advice on the chances and reliability of the screening functional movements as a part of pre-participation and returns for sports testing.

Based on those five benefits gained from the application of FMS, there are at least seven instruments that were developed to determine the development of the children's motoric movements. The FMS instruments are as follows: (a) Deep Squat at Chair, (b) Hurdle Step, (c) Lunges, (d) Shoulder Mobility, (e) Active Straight-Leg Raise, (f) Trunk Push and (g) Rotary Stability. The details of the Functional Movement Screening (FMS) instrument have its suspension rubric in the following Table 1.

Table 1. Functional movement screening test

DIMENSIONS	Assessment Rubric
A. Deep Squat at chair 	Tester first sat on the seat then the seat was taken slowly until the tester performs a deep squat. 1. Tibia (shinbones) and the upper body are not aligned. Thigh bones are over the horizontal line of the knee. The knee is not aligned (exceeding) with the toe. Lumbar (waist) is bent as a record. 2. The upper body is parallel to the tibia (shinbones) or towards the vertical direction. Thigh bones are below the horizontal line. Knees are not aligned over feet. Heel is higher. 3. The upper body is parallel to the tibia or in the vertical direction. Lower the thigh bones horizontally. Knees are aligned over feet. The stick is parallel to the legs. **Tips for the testing** • When in doubt, the subject score is low. • Do not assess first while still testing the tester • If you are still unsure, try to view the subject from the side

B. Hurdle Step

1. A contact between the legs and obstacles, thus losing balance.
2. Loss of balance between the hips, knees, and ankles. Stick and obstacles are misaligned.
3. Hips, knees, and ankles remain aligned in the centre of the right and left body. Minimal for no movement is recorded in lumbar spine. Stick and obstacles remain parallel.

Tips for the testing

- Rate only for the foot that can step beyond the obstacles
- Ensure the tester to retain the body stability
- Tell the tester not to lock the knee leg during the test
- Maintain precise alignment between the rope and
- Upper Dry Bone is bulged
- When in doubt, lower the score
- Do not judge first while still testing the tester

C. Lunges

Hand holding the stick behind the upper body, kneeling with one foot while the other foot is retracing the floor.

1. When kneeling and standing the body is leaning forward and tilted.
2. When kneeling and standing the body is leaning forward.
3. When kneeling and standing, upright the body.

Tips for the testing

- The front foot indicates the side to be assessed
- The stick is placed behind the head, chest, spine, and waist area during the kneeling
- The front heel remains in touch with the surface part and the rear heel touches the surface section when returning to the starting position.
- When in doubt, lower the score.
- Pay attention to the loss of balance.
- Stay close to the tester if he/she loses balance.

D. Shoulder Mobility

1. Fist is not fused from half the length of the sleeve.
2. Fist is distanced by one hand balls.
3. The fist is in one hand.

Tips for the testing

- Shoulder flexibility identifies the side per side in the assessment.
- If the hand size is equal to the distance between two points, the score is low.
- The last test, if acceptable, then the score depends on the rest.
- Make sure the tester does not move hands against each other.

E. Active Straight-Leg Raise

1. Vertical stripe of the foot is below the line together. The limbs remain in Neutral position.
2. Vertical stripe of the leg is between the Mid thighs and joints. The limbs remain in neutral positions.
3. Vertical line of ankles is between Mid-thigh and prominent hip bone area. The limbs remain in Neutral position.

Tips for the testing

- The moving limbs identify the side per side in the assessment.
- Make sure the leg that not being moved (on the floor) maintains a neutral position (no external rotation of the hips).
- Both knees should stay extended, and the foot that is on the floor must remain in contact with the floor.
- If the stick is exactly at the halfway point, the score is low

F. Trunk Push

1. Hip and lumbar (waist) are curved, the area of the thorns (back) is curved.
2. Hip and lumbar (waist) are curved, the area of the thorns (back) is parallel.
3. All the spine is straight from the neck to waist.

Tips for the testing

- Athletes should lift the body as a whole.
- Make sure that the original hand position is retained.
- Ensure that the position of the body and limbs are parallel and straight
- If in doubt, the score is low.

G. Rotary Stability

1. Hands are vertical straight, while the legs are bent and the body is unsteady.
2. One leg and one hand are raised in the opposite direction, the body is tilted (unsteady).
3. The lifted leg and hand are straight to the body like a table.

Tips for the testing

- The raised arm (hand) is being tested.
- The moving limbs must remain stable for 2 x 6 boards to reach the score "3".
- Make sure that the spine is flat, and the hips and shoulders are steady.

Discussion

Implementation mechanism of the functional movement screening test procedure is as follows (Wright & Chesterton, 2018):

1. Deep Squat, performed by sitting on a chair while holding the stick, and then stand up. Then the seat is taken followed by sitting squatting, and the arm remains straight upward.
2. Hurdle Step, performed by carrying a stick across the shoulder, both hands hold the stick, standing up behind the obstacles with the height of the obstacles are adjusted to the bone that stands out under the knee, the distance between the obstacles and the limbs is one fist. Furthermore, one leg is lifted to step past the obstacles and carried out alternately.
3. Lunges, performed by placing the stick on the back, both hands are holding the stick. Right hand on the top, left hand on the bottom. Then kneel with the right foot into a focus on the floor. While the left foot is bent forward, and vice versa.

4. Shoulder Mobility, performed in the standing position, the right arm is bent behind the head and put together with the left arm that also be bent back but through the lower back, and move the fists close to each other as close as the fists being put together.
5. Active Straight-Leg Raise, performed by the way the body is stretched in which both arms are straightened on the side of the body, and then one leg is lifted straight perpendicular to the body through the boundaries given and carried out alternately with the other leg.
6. Trunk Push, performed by positioning both arms of the body, the back and the two straight limbs parallel.
7. Rotary Stability, performed by imitating the position of crawling, the right hand and left knee as a focus.

The FMS Test movement is made to be used in the screening of fundamental movements, based on the principles of proprioceptive and kinesthetics consciousness. Each test is a specific movement which requires the appropriate function of the body's kinetic connective system (Soltandoost & Shamsoddini, 2020). The kinetic link model is used to analyse movements. It describes the body as a connected system of interdependent segments. The movement of the body without being noticed by the human brain command is called the proprioception movement. Proprioception can be defined as a specific variation of a touch sensory modality that includes the sensation of joint movement and understanding of the joint position. There are 15 proprioceptors in each kinetic chain segment that should function properly so that efficient movement patterns can occur. The proprioceptive input provides the basis for all motoric control (motoric output) and human movements (Syafei et al., 2020; et

When a child performs daily physical activities both at home and school, such as moving from sitting to standing position, the position takes the ball below, the position goes on the point, the position of stepping past the obstacles while playing with his/her friends, the crawling position, playing the sticks as if in a fantasy play, jumping and running (Wang, Lin, Kulmala, Pesola, & Gao, 2021). These movements are voluntary and controlled effort to train and learn skills. After several repetition then the movements above will be stored centrally as a complex motor program and motor learning process (Taylor, Moorman, Marszalek, Albur, Dohm, & Thomas, 2019; Trinidad-Fernandez, Gonzalez-Sanchez, & Cuesta-Vargas, 2019).

It is important to note that motor learning is not about certain parts of the body, joints, or the use of isolated muscles. Instead, it is about synergy, balance, symmetry, and skill during the overall movement pattern especially in children (Endo, Ueta, Matsu, & Oishi, 2021). Over time, each motor program requires fewer cognitive commands that lead to an improved unconscious task performance. This subconscious performance involves the highest degree of central nervous system function, known as cognitive programming (Wu et al., 2020; Yildiz, Pinar, & Gelen, 2018). From these reviews the child indirectly performs a fundamental movement of skill that corresponds to each function. In addition, it will lead the child to be more independent in making life skills.

Conclusion

Every child that has been born naturally has the desire to move. Proprioceptive is a way for every child to trace the stage of the child's motoric development. The FMS Test instrument can be used in finding out the development of motoric movement of the children. It consists of 7 dimensional as follows: (a) deep squat at chair, (b) hurdle step, (c) lunges, (d) shoulder mobility, (e) active straight-leg raise, (f) trunk push and (g) rotary stability. The FMS test movement is made to be used in the screening of fundamental movements, based on the principles of proprioceptive and kinesthetics consciousness. Each test is a specific movement which requires an appropriate function of the body's kinetic connective system. In addition, one thing to be remembered is that motoric learning is not just about the body, joints and muscles, but the main thing is to create synergy, balance, symmetry, and skills during the overall movement patterns.

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