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The 360° TitaniUM Core Strength Exercise® Improve Balance in Teenager

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Abstract--- *The core is described as an anatomical box consisting of 29 pairs of muscles forming a front (abdominals), back (paraspinals and gluteals), top and bottom (pelvic floor and hip girdle). It represents the connection between lower and upper limbs and should be considered as a functional unit in which different muscles interact, even if not located in the thoraco-lumbar region (such as shoulders and pelvic muscles). Exercises involving the full body linkage such as core strength training have been advocated to enhance the capacity of transmitting force through the body linkage. Balance is ability to maintain a stable posture with body mass centre in the domain of base of support while counteracting external or internal conflicts. Several potential mechanisms exist to explain ability to improve balance, most of which involve the improved functioning of the nervous system or strengthening of the core. The 360° TitaniUM Core Strength Exercise® is a new sequence of exercise to strengthen the core region muscles, it consisted of twelve isometric exercises and the participants carried out the exercises in sequence with each exercise session consisted of 10-20 seconds/exercise progressively, 3 sets every session with the rest period of one minute between sets. The primary aim of this study was to explore whether 12-week of 360° TitaniUM Core Strength Exercise® could elicit significant improvement of balance stability in teenager. 40 teenagers, 20 males and 20 females age 14 to 16 years old were recruited for this study. Results revealed that 12 weeks 360° TitaniUM Core Strength Exercise® induced significant improvements of balance stability in teenager between pre-test and post-test [t (39) =-8.29, p<0.001]. From the results of this study, we can conclude that the 360° TitaniUM Core Strength Exercise® is suitable and effective training method to improve the balance stability in teenager.*

Keywords--- *360° TitaniUM Core Strength Exercise®, Balance in Teenager*.

I. INTRODUCTION

The core was described as an anatomical box consisting of 29 pairs of muscles (Diagram 1) forming anterior muscles (abdominals & adductors), posterior muscles (paraspinals and gluteals), (Richardson, Jull, Hodges, & Hides, 1999). Exercises involving the full body linkage such as Core Strength Training, have been advocated to enhance the capacity of transmitting force through the body linkage (Schoenfeld, Aragon, Wilborn, Krieger, & Sonmez, 2014). An efficient core allows for optimal acceleration, deceleration and stabilization of the entire kinetic chain during functional exercise. The core needs to be trained appropriately in order to efficiently distribute weight, absorb force, and transfer ground reaction forces during functional movements. The core muscles also stabilize the spine and trunk during movements of lower and upper extremities such as jumping, running, and throwing.

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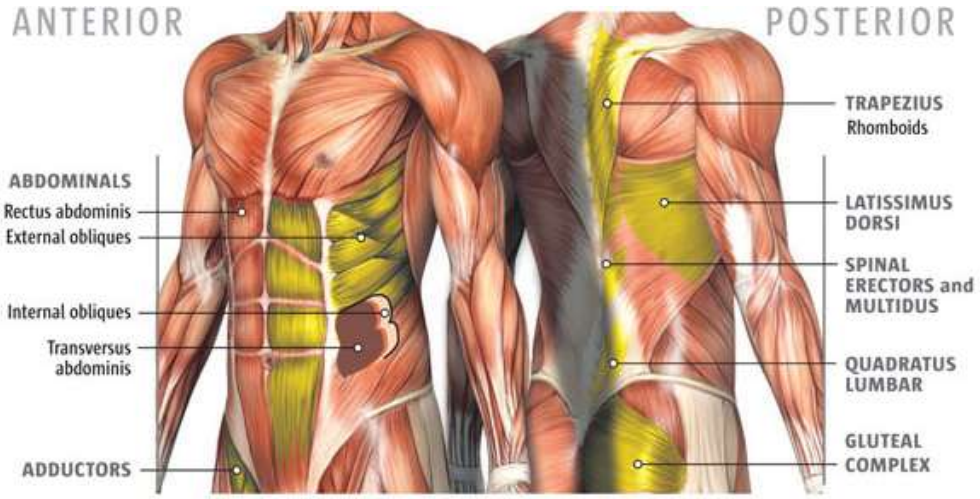

Diagram 1: Core Muscles (Anterior and Posterior)

Core strength training differs from many traditional weight training routines by working both the lower back and abdominals in unison. The 360° TitaniUM Core Strength Exercise® is a new sequence of exercises to strengthen the core region muscles. It is easy to remember with no specific equipment needed to carry out this exercise. It is suitable for all athletes and non-athletes. The structured sequence of exercises would enable the practitioners to experience greater efficiency of movement; improved body control and balance; increased power output from both the core musculature and peripheral muscles such as the shoulders, arms and legs; reduced risk of injury. At such, well-developed core strength may contribute to stabilizing the core by stiffening the torso and transferring the energy of the legs to the upper extremities (Roth, Donath, Kurz, Zahner, & Faude, 2017).

Maintaining upright body posture is fundamental for humans. Therefore, research concerning balance control and postural stability are very diverse. Several clinical and laboratory methods have been developed which enable researchers to asses different dimensions of the postural control system (Rzepka, 2007). Experimental protocols are usually designed to asses postural steadiness or postural balance. Postural balance refers to the ability to stay upright within the base of support, or to recover equilibrium after external dynamic perturbation.

Balance is ability to maintain a stable posture with body mass centre in the domain of base of support while counteracting external or internal conflicts (Hosseinimehr & Norasteh, 2010). Instability of balance can demonstrate main health problems in human beings, therefore knowledge of centre of gravity within the human body and support base is crucial for constant adjustments to the muscular activity and joint positioning, which simulate a motor function that ensures a connection among sight, deep sensory organs that support antigravity muscles to maintain the standing posture. Balance depends on coordinated integration of somato-sensory, vestibular and visual input (Park, Oh, & Kim, 2014). Core strength training targets the muscles deep within the abdomen which connect to the spine, pelvis and shoulders, to assist in the maintenance of good posture and provide the foundation for all arm and leg movements (Akuthota, Ferreiro, Moore, & Fredericson, 2008).

Centre of pressure (CoP) emerges as the most common variable among others registered with the use of force plates. It is defined as the point of application of ground reaction forces under the feet. CoP is the outcome of the

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inertial forces of the body and equilibrium restoring forces of the postural control system. CoP displacement is used to investigate neurological and biomechanical mechanisms of postural control (Ruhe, Fejer, & Walker, 2011).

Objectives of the Study

1. To determine the balance stability of the teenager
2. To find out the effectiveness of 360° TitaniUM Core Strength Exercise® on balance stability between pre and post intervention.

II. METHOD

Participants

Participants of this study were recruited form the Sultan Abdul Samad Secondary School under the adopted school's schemes with UMCares. A total of 20 male and 20 female students aged 14 to 16 years old were recruited, written consent forms were obtained from their parents and the school authority to conduct this study.

Instrumentations

All participants were tested on Pre and Post Intervention with Lafayette Stability Platform with Digital Control. The intervention was carried out for 12 weeks, all data collected was analysed using SPSS version 22. The results of this study provided information on the effectiveness of 360° TitaniUM Core Strength Exercise® on balance stability among teenager.

The Lafayette Stability Platform with Digital Control Model 16030SR (Figure 1) is designed to measure balancing ability, which is essential to successfully performing many activities. The Stability Platform features fully integrated timing functions for test control and electronic angle measurement for unsurpassed accuracy.

The platform's control allows a wide range of user customisation including variable test times, selectable angle limits, and digital tilt angle readout. The Stability Platform's rugged design and electronic capabilities mean that it will be able to provide many years of reliable operation.

Figure 1: Lafayette Stability Platform with Digital Control Model 16030SR

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Procedures

The pre-test data were collected at the Motor Behaviour Lab, Centre for Sport and Exercise Sciences, University of Malaya. Trained project staff administered the testing following a standardized protocol that emphasized the confidentiality.

After completed the pre-test, the participants were briefed and guided to perform the 360° TitaniUM Core Strength Exercise® (Figure 2). All subjects were given a book of 360° TitaniUM Core Strength Exercise® as a reference.

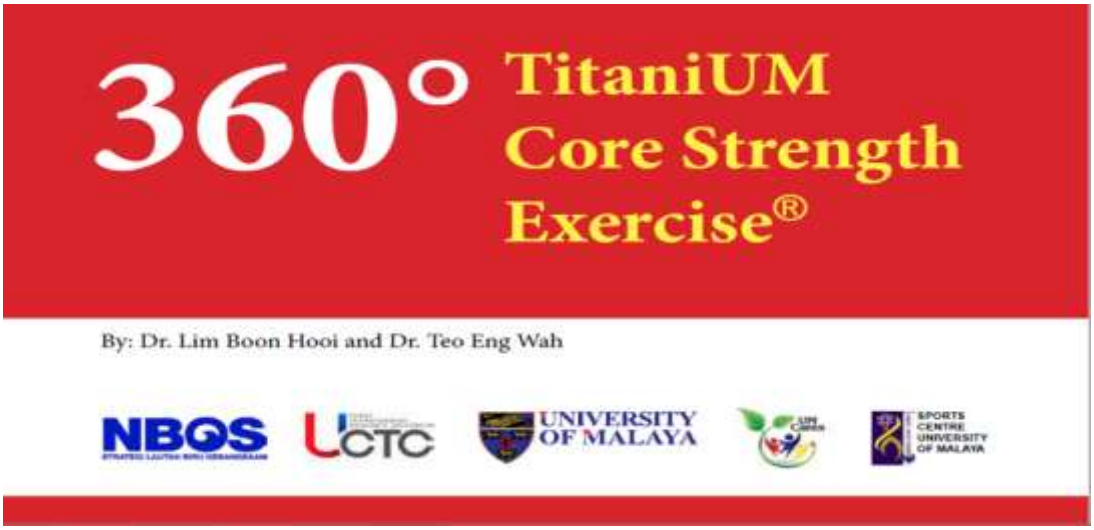

Figure 2: 360° TitaniUM Core Strength Exercise®

The post-test data collected in the same Motor Behaviour Lab, Centre for Sport and Exercise Sciences, University of Malaya when the participants completed their 12-week intervention program. The same procedures in the pre-test were applied in the post-test. During the intervention period, the subjects began the training 3 times/ week for 12 weeks. The 360° TitaniUM Core Strength Exercise® consisted of twelve isometric exercises: 1). double elbow prone bridge; 2). right elbow lateral bridge; 3). both legs supine bridge; 4). left elbow lateral bridge; 5). both hand prone bridge; 6). right hand lateral bridge: 7). left leg up supine bridge; 8). right leg up supine bridge; 9). left hand lateral bridge; 10). alternate left hand right leg; 11). alternate right hand left leg; 12). superman. All these exercises should have performed in sequence as figure 3.

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11		12	

Figure 3: Sequence of Performing the 360° TitaniUM Core Strength Exercise®

Each exercise has to be maintained for 10 seconds in the first month and increases progressively in duration to perform these exercise from 10 seconds to 20 seconds as table 1. The researcher monitored during the participants performing these exercises to ensure that the technique is correct and timing each exercise during intervention period.

Table 1: Schedule of Performing the New IET Programme

Month	*Frequency*	*Duration*	*Set*
First month	3 sessions/week (Guided by researcher)	10 seconds/exercise	3
Second month	3 sessions/week (Guided by researcher)	15 seconds/exercise	3
Third month	3 sessions/week (Guided by researcher)	20 seconds/exercise	3

Statistical Analysis

All data are expressed in mean and standard deviations (Mean ± SD). All statistical analyses were performed using IBM SPSS Statistics for Windows, version 23, Armonk, NY: IBM Corporation and the significance level was set at $P < 0.05$.

III. RESULTS

All participants (n=40) adhered and completed the required 36 sessions of the 360° TitaniUM Core Strength Exercise® over 12 weeks training period.

Table 2: Mean, Standard Deviation and t-test Results

Test	*Mean*	*Standard Deviation*	*t*	*df*	*Sig. (2 tailed)*
Pre-test	1.01	0.96	-8.29	39	0.001
Post-test	3.25	1.79			

Results indicate a significant improvements of balance ability between pre-test (M=1.01, SD=0.96) and post-test (M = 3.25, SD = 1.79), t (39) = -8.29, p < .001.

IV. DISCUSSION

The main objective of this study was to find out the effectiveness of the 360° TitaniUM Core Strength Exercise® on balance stability between pre and post intervention. Results indicated that 12 weeks of the 360° TitaniUM Core Strength Exercise®, 3 sessions/week, with 10 seconds to 20 seconds/exercise progressively is able to induce significant improvements of the balance stability in teenager. Therefore, the novel of this new core strength protocol

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utilised within this study appears to provide a viable alternative method for the strengthen the core strength muscles and directly improved the balance in teenagers.

The 360° TitaniUM Core Strength Exercise® consisted 12 isometric exercises, performing in sequence and targeting on 29 pairs of core strength muscles. At such, theoretically, it could be argued that this new core strength exercise might result in both a greater magnitude (and possibly a greater rate) of with other core exercises. It has been hypothesised that isometric contractions of a greater muscle mass require an increased central and peripheral drive (Mitchell, 1991; Soares et al., 2019).

Results of this study indicated that the balance ability of the participants improved significantly between pre-test and post-test [t (39) = -8.29, p < .001] after intervention. The results obtained is supported a few previous studies from the literature sources, balance stability is determined by the ability of the human body to keep the vertical position at rest, while walking, running or during other physical activities. The balance stability is the ability to maintain static or dynamic position of the body. Previous study reported that the sensitive period of the balance stability between 11 and 14 years of age for girls and one year later for boys (Ricotti, 2012). Several authors (Balter, Stokroos, Akkermans, & Kingma, 2004) suggest that the high level of balance stability development is a direct result of the numerous repetitions which affects the motor response. Also, the age of participants for this study are between the range of sensitive period for balance stability. Also, current results supported previous studies which repetitions will affected the motor response where by the intervention was carried out with repetitions throughout 12 weeks.

Researchers proposed that improved balance could decrease the amount of musculature involved in stabilization, allowing more muscles to contribute to force production in a given movement (Murphy, Santo, Alkanani, & Behm, 2010). The process of balancing is complex and requires specific coordination of the core and limbs. Balance is defined as an ability to maintain the centre of gravity within the base of support (Yaggie & McGregor, 2002). To maintain balance, the brain receives feedback from various systems including visual, vestibular, and somatosensory (Hrysomallis, 2011). Also, balance training may lead to neural adaptations at the spinal and supraspinal level that suppress reflex activity. This suppression may improve muscle contraction properties and result in more stable joints, allowing for better balance (Beinert & Taube, 2013).

Static Stabilometry is a set of balance tests carried out after standing on the platform by using resources for reducing the stability, tests performed with extended arms and closed eyes. Results of this study is similar to the previous study which used an untrained female population to compare curl-up and back extensor exercises performed on a physioball to the same done on the floor (Cosio-Lima, Reynolds, Winter, Paolone, & Jones, 2003). The physioball trained group showed significant improvements in abdominal EMG activity and balance times compared to the floor exercise group. Current results also supported previous study which showed that core strength and endurance training program two times per week for six weeks led to significant enhancements in 3 different core endurance tests (back extensor endurance, flexor endurance, and lateral musculature endurance) in ten untrained college students (Schilling et al., 2012).

The CoP is the outcome of the inertial forces of the body and equilibrium restoring forces of the postural control

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system. CoP displacement is used to investigate neurological and biomechanical mechanisms of postural control (Ruhe et al., 2011). From the results of current study, it supported that the CoP displacement of the participants were improved due to neurological and biomechanical of the postual control after the intervention.

Previous studies revealed that trunk muscle fatigue led to decreased dynamic stability of the trunk and loss of balance control (Davidson & Kabat-Zinn, 2004). At such, strengthen the core muscles will reduce muscle fatigue and able to improved balance stability in longer duration.

In conclusion, the 360° TitaniUM Core Strength Exercise® is suitable and effective training method to improve balance stability in teenager after 12 weeks of intervention. Future study may be implementing the TitaniUM Core Strength Exercise® on the senior adults to improve their balance and ultimately to prevent falls among senior citizen.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

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Photos Related to This Study

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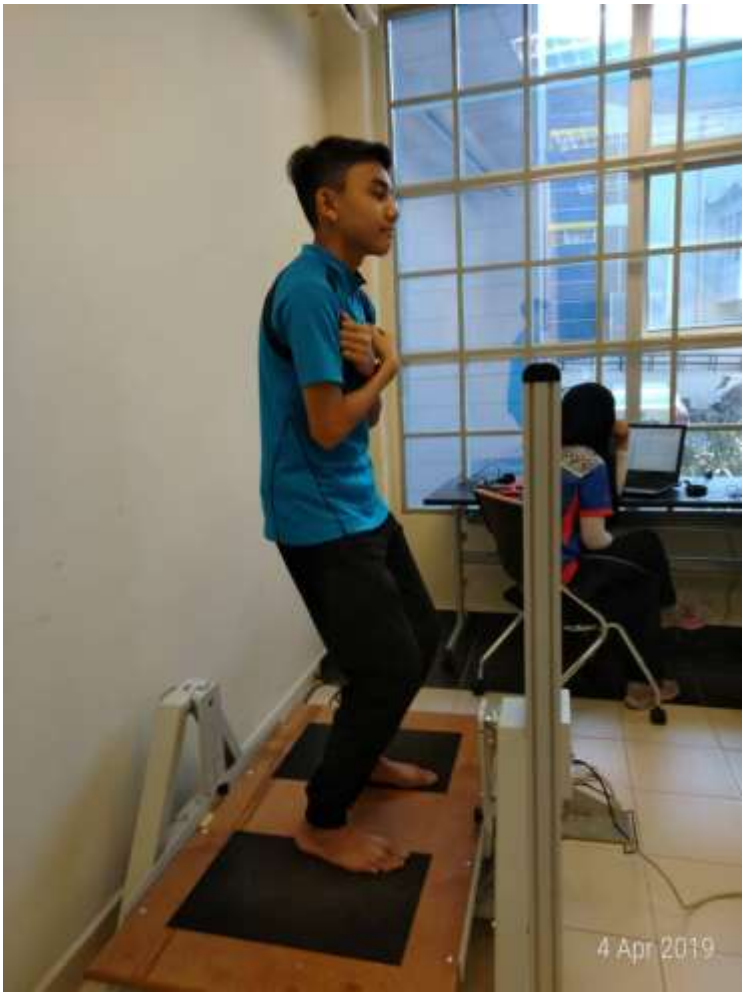

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