External or Internal Attention for Vertical Mass Displacement

Mir Hamid Salehian[1], Recep Gursoy[2], Elhan Şen[2], Mohsen Shir Mohammad Zadeh

1. Department of Physical Education, Tabriz branch, Islamic Azad University, Tabriz, Iran
2. Associate Professor, Department of Physical Education and Sport Sciences, Ataturk university, Erzurum, Turkey
3. Department of Physical Education and Sport Sciences, Azarbayjan Shahid Madani University, Iran

Abstract : The purpose of this study was to determine the effect of two different kind of attentional focus (internal and external) on trunk vertical displacement in university male basketball beginners. Thirty male students were chosen voluntarily with no knowledge of basketball and matched in 2 groups: Internal (focus on the ball) and External (focus on the basket). Following the ten practice sessions and after a day of rest a retention test was conducted for each group. Data were analyzed by independent T test. By analyzing the proposed hypotheses at the $P \leq 0.05$ showed the superiority of external focus than internal one on trunk vertical displacement.
[Mir Hamid Salehian, Recep Gursoy, Elhan Şen, Mohsen Shir Mohammad Zadeh. **External or Internal Attention for Vertical Mass Displacement.** *Life Sci J* 2012;9(4):3669-3672]. (ISSN: 1097-8135). http://www.lifesciencesite.com. 544

Key words: external attention, internal attention, displacement

1. Introduction

There has been some evidence that an individual's focus of attention has a significant influence on motor performance and learning. It has been shown that directing a performer's attention to the movement effect (external focus), is more beneficial than attention directed to the movement itself (internal focus) (Wulf at al., 1998, 2001, Wulf, 2007 a, b). Most research has used skills that require the manipulation of an object to achieve the action goal, such as hitting a golf ball (Wulf at al., 1999; Perkins-Ceccato at al., 2003; Wulf & Su, 2007), shooting a basketball (Al-Abood at al., 2002; Zachry at al., 2005), kicking a football (Zachry, 2005) or soccer and volleyball (Wulf at al 2002, 2003), hitting a tennis ball (Wulf at al., 2000), baseball (Castaneda, & Gray, 2007), and even dart throwing (Marchant, 2007). The advantages of an external focus are not only seen when compared with internal focus conditions, but also when compared with control conditions (Landers at al., 2005; McNevin, 2002, 2003). This pattern of results suggests that an external focus has the capacity to enhance performance and learning. The rationale for focusing on the movement effects rather than on the movement itself is explained by the "constrained action hypothesis" (McNevin at al., 2003; Wulf at al., 2001). This hypothesis suggests that directing one's attention to the actual movements (internal focus) might "constrain" the motor system and interfere with the automatic control processes, while focusing on the effects of the movement (external focus) actually frees up the performer and enhances the automatic control processes. Overcoming this analysis paralysis, participants focus on the effects of their actions so the movement pattern becomes more "automatic", demonstrating a smooth, coordinated response; For example, balancing on a stabilometer (Wulf et al., 2001), postural adjustments in balance tasks (Wulf at al., 1999, 2001, Wulf, 2007), hitting a target (Wulf at al., 1999, 2002) or balancing (Wulf at al. 1998, Landers at al., 1999 Shea & Wulf, 1999; Totsika & Wulf, 2003), but also for tasks that require the production of maximal forces and displacement of the center of mass (Vanezis & Lees, 2005; wulf at al., 2007; Salehian, 2011). Zachry et al. (2005) believed that an external focus of attention not only enhances movement efficiency, but also reduces "noise" in the motor system that delays fine movement control and disturbs the outcome of the movement. This indicates that participants produced greater forces under that condition.

Although evidence is convincing regarding the effectiveness of an external focus in practicing motor skills, there is still much to be discovered. Conflicting findings demonstrate that age (Emanuel at al., 2008) , gender (Wulf at al., 2003) , skill level (Perkins at al., 2003; Ford at al., 2005; Castaned & Gray, 2007; Wulf, 2008), complexity of the skill (Poolton at al., 2006; Denny, 2010), and individual preferences (Wulf at al., 2001), sport settings (Porter at al., 2010) might all play a role regarding the efficacy of internal and external attention focus in skill performance. Recently, Weiss et al. (2008) discovered that one's preferred focus of attention could play a role in the effectiveness of attention focus, suggesting that an internal focus did not necessarily lead to a decrease in performance if it was the participant's preferred strategy. On the other hand, some studies done on the effect of kinematics

parameters on the optimal shooting have paid only to factors influencing on successful shooting in basketball, but some of these factors are common in unsuccessful shooting, too (Kudson, 1993). Some techniques such as release angle, speed, velocity and height, launch of the force to be applied to the ball, speed and angle of shoulders and trunk play greater roles on a successful throw (Raul, 2002). Vanezis and Wulf believed displacement of the trunk on doing a task such as jump and reach is an important factor to reach the aim (Vanezis & Lees, 2005; Wulf, 2009), and it is believed mass displacement plays a great role in successful basketball free throw (Raul, 2002), but to prove this matter there is a need to do more researches.

So, according to the contrary results we decided to examine whether an external focus would have a great impact on trunk vertical mass displacement in university male basketball beginners, compared to internal focus. If this were the case, it would complement and extend the findings of previous studies, which have almost exclusively shown benefits of external focus for tasks requiring movement accuracy. In two experiments, participants performed a shooting task under two conditions. Under external focus conditions participants were instructed to focus on the basket, whereas under internal focus conditions they were asked to focus on the wrist.

2. Methods

Thirty male students (age 18- 30 years) from Tabriz Islamic Azad University, with no knowledge of basketball shooting and not aware of the specific purpose of the study were assigned randomly to one of two experimental groups (n=15) based on their pre-test scores of 10 shooting. The two matched groups were assigned one of two practice conditions. On the ten consecutive sessions of practice, all participants received the same initial instructions regarding the basket (external) and wrist (internal), but no feedback during the post-test. After a day of rest, participants performed a retention test consisting of 10 trials with 10 seconds rest between each trial. The task involved was the throwing ball toward basket from penalty line in basketball, putting markers on the subjects' trunk vertical mass displacement and recording the motions from sagittal and frontal surfaces by two Panasonic cameras with 100 fps speed. A motion analysis software was used to analyze information.

Descriptive statistics were calculated to report the mean performance of the two practice groups for the retention test scores (Table). Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 16. An independent samples t-test was used to determine significance between the experimental conditions.

Table 1. Center of Mass Displacement under Internal and External Focus Conditions

Segments	Groups	Mean	Std. dev	T	Df	Sig.
Trunk	Internal	2.18	0.409	-	28	0.000*
	External	3.22	0.765	4.66		

As it shown in Table 1, the mean displacement of trunk vertical for internal group was 2.18 and for external group was 3.22 with F (9.58) =, $p < .05$.

3. Results

Participants' trunk vertical mass displacement reached a higher changes when they were instructed to adopt an opposed to an internal focus, (3.22) for external focus group, and internal focus (2.18), (see table). independent t-test showed a statistical significance between the two practice conditions in trunk vertical mass displacement ($p= .000$).

4. Discussion and Conclusions

The purpose of this investigation was to determine if trunk vertical mass displacement in an external focus would be better than an internal focus when performing a basketball set shot. Among numerous studies on attention focus, few have considered the effects of attention focus on trunk vertical mass displacement. Traditionally, coaches and teachers have been trained in teaching sport skills using an internal focus of attention. The result of this study supported that an external focus was more effective than an internal focus in trunk vertical mass displacement when performing shooting in basketball and as Raul (2000) believed mass displacement of body had an important impact on successful shooting. This finding appears to be parallel to several studies exploring the benefits of an external focus when compared to an internal focus, including, the basketball free throw (Al-Abood et al., 2002), the standing soccer shot and volleyball serve (Wulf et al., 2002), the golf pitch shot (Wulf et al., 1999), putting (Poolton et al., 2006) and center of mass displacement (Wulf et al., 2007; Salehian, 2011). Throwing ball to the basket used in this study involving several variables, including the attentional focus of the performer. These factors may explain the difference in the results of this study compared to other studies done on this topic. The only way to raise the mass displacement is by increasing the magnitude of external force exerted. From a performance perspective, one can deduce that participants either increased force production, or optimized coordination between and among the

segments during a task to produce a more continuous summation of segmental velocities (Wulf et al., 2007).

The results of the present study provide converging evidence that a change in the focus of attention can affect greater COM displacement (Vanezis & Lees, 2005; Wulf, 2007, Salehian, 2011): Focusing on a target (external focus) resulted in greater trunk vertical mass displacement in than focusing on the wrist with which the ball was to be thrown (internal focus) and at last a successful throw was acheived. Moreover, attentional focus instructions have been found to affect EMG activity not only in "related" muscle groups, but also in "unrelated" muscle ones (Zachry, et al.2005, Vance, et al., 2004). The present results are in line with those findings in demonstrating that the attentional focus on one part of the body can impact whole-body displacement. Wulf 's experiments (Wulf et al., 2007) showed greater vertical displacement of the center of mass. This indicates that participants produced greater forces under that condition. While it might be surprising that a simple change in an individual's focus of attention can enhance force production, and previous studies have shown that an external focus results in more efficient movement patterns (Zachry, et al., 2005, Vance, et al., 2004, Marchant, et al., 2006). In those studies, the same outcome (i.e., weight lifted in a given amount of time) was achieved with less muscular activity when an external focus, as opposed to an internal or no particular focus (Vance, et al., 2004, Marchant, et al., 2006). Interestingly, muscular activity was reduced not only for agonist muscle groups, but also for antagonist muscles (Marchant, et al., 2006). This suggests that a focus on the movement effect might not only facilitate an effective recruitment of intra-muscular, but also inter-muscular coordination (Hollmann & Hettinger, 2000). Marchant et al.'s (2009 b) study also showed beneficial effects of an external focus on maximum force production. Using an isokinetic dynamometer, they had participants produce maximum voluntary contractions of the elbow flexors under internal-focus (focus on arm and muscles) or external-focus (focus on the crank hand-bar) conditions. The results showed that participants produced significantly greater peak joint torque when they focused externally compared with internally.

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9/6/2012