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Use of video observation and motor imagery on jumping performance in national rhythmic gymnastics athletes

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ABSTRACT

The aim of this study was to evaluate whether a mental training protocol could improve gymnastic jumping performance. Seventy-two rhythmic gymnasts were randomly divided into an experimental and control group. At baseline, experimental group completed the Movement Imagery Questionnaire Revised (MIQ-R) to assess the gymnast ability to generate movement imagery. A repeated measures design was used to compare two different types of training aimed at improving jumping performance: (a) video observation and PETTLEP mental training associated with physical practice, for the experimental group, and (b) physical practice alone for the control group. Before and after six weeks of training, their jumping performance was measured using the Hopping Test (HT), Drop Jump (DJ), and Counter Movement Jump (CMJ). Results revealed differences between jumping parameters $F(1,71) = 11.957$; $p < .01$, and between groups $F(1,71) = 10.620$; $p < .01$. In the experimental group there were significant correlations between imagery ability and the post-training Flight Time

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of the HT, $r(34) = -.295$, $p < .05$ and the DJ, $r(34) = -.297$, $p < .05$. The application of the protocol described herein was shown to improve jumping performance, thereby preserving the elite athlete's energy for other tasks.

1. Introduction

Imaging a motor action means both activating a motor program and inhibiting the outflow signals at a certain stage so that no overt behavior will occur (Jeannerod, 2001; Munzert, Zentgraf, Stark, & Vaitl, 2008; Moran, Guillot, MacIntyre, & Collet, 2012). Mental training efficacy in improving sports performance is widely recognized (Smith, Holmes, Whitemore, Collins, & Devonport, 2001; Smith, Wright, Allsopp, & Westhead, 2007; Smith, Wright, & Cantwell, 2008).

Several studies, conducted to establish the mechanism underlying the performance-enhancing effects of imagery, showed overlapping neural representation (Grezes & Decety, 2001).

A strong correlation between real and simulated movements was found in several research efforts (Heremens, Helsen, & Feys, 2007; Nikulin, Hohlefeld, Jacobs, & Curio, 2007; Sharma, Jones, Carpenter, & Baron, 2008). As a result of these findings, motor imagery has been a widely used strategy for improving motor performance, considering that action representation is critical in effective action planning (Caeyenberghs, Roon, Swinnen, & Smits-Engelsman, 2009; Munzert & Zentgraf, 2009; Smith et al., 2001, 2007, 2008) and that the skill to mentally visualize an action is important in the development of motor control (Gabbard, 2009). Various methods have been devised to maximize the effect of mental training with imagery on sports performance. One of the most extensively used methods is the Physical, Environment, Task, Timing, Learning, Emotion Approach (PETTLEP) (Holmes & Collins, 2001; Smith et al., 2007, 2008), based on the functional equivalence hypothesis (Finke, 1979; Moran, 1996). PETTLEP intervention should simulate, as closely as possible all aspects of participants' execution situation, especially the sensation associated with relevant movements and their subsequent emotional impact (Wakefield, Smith, Moran, & Holmes, 2013). Despite the different interpretations about the functional equivalence validity of PETTLEP model, on the top of recent research findings, the importance of matching closely the imagined and actual motor skills is largely recognized. (Ramsey, Cumming, & Edwards, 2008; Wakefield et al., 2013).

In fact some studies have found PETTLEP-based intervention to be effective using tasks such as the long jumps, gymnastic jumps and strength tasks (Lebon, Collet, & Guillot, 2010; Reiser, Busch, & Munzert, 2011; Wright & Smith, 2009). The extension of PETTLEP model is to include action observation and imitation of others. The neurological phenomenon related has received considerable attention in the neuroscience literature (Rizzolatti & Craighero, 2004). The influence that watching oneself or others can have on one's own performance, as well as on psychological variables such as self-efficacy, and self-regulation has been well recognized (Mc Cullagh, Law, & Ste-Marie, 2012). Various terms have been used to describe this phenomenon, including observational learning or modeling, and recent researches showed how athletes use observation in realistic sport settings to enhance sport performance (Munzert et al., 2008; Ste-Marie, Law, Rymala, Craig Halld, & McCullagh, 2012). The neural isomorphism with overt behaviors offers a tempting mechanism to explain the beneficial outcomes of the two processes. However Imagery, in the context of sport, may be considered as the neural generation or regeneration of parts of a brain representation/neural network involving primarily top-down sensorial, perceptual and affective characteristics, that are functionally equivalent to the actual sporting experience, under the conscious control of the imager and which may occur in the absence of perceptual afferences. Observation, in the context of sport, may be considered as the neural stimulation of a brain representation/neural network involving primarily bottom-up sensorial, perceptual and affective characteristics, that are primarily under the subconscious control of the observer and which may occur in the presence of afference functionally equivalent to the actual sporting experience