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Editorial

Motor Imagery and Postural Control in Healthy Subjects: Future Prospects for Neuroscience

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The motor imagery (MI) can be defined as the act of codifying the mental rehearsal of an intended action, without executing it. The MI has two strategies: (1) kinesthetic (first person), which the individual feels himself executing the movement and (2) visual (third person), which the individual sees the movement performed by himself or by another person.

Studies suggest that kinesthetic MI (first person) has a specific sensorimotor network that modulates corticospinal activity with greater amplitude than the visual IM. There are speculations that visual MI occurs through a different network associated with the mirror neuron network (parieto-frontal), which is activated, by the observation of an action (third person). Thus, both the visual strategy of MI as kinesthetic MI has a distinct mental construction and therefore, could be expected their repercussions on the postural control.

Furthermore, different factors may determine the ability of an individual mentally simulate different movements, such as age, gender, and the difficulty of the task (skill/motor experience). Some properties observed during the motor execution (ME) are also present during the MI, suggesting that there are similarities in the mental states during the ME and IM of the same task. Initially, the majority of these studies used mental chronometry techniques. With advances in neuroimaging techniques, existence of overlap between the neural circuits during the ME and MI of the same task was demonstrated.

By definition, posture is the relative position of various body parts in relation to each other and relative to the environment involving the gravitational field. The postural control system depends on three functional components: (1) biomechanics, involving muscular and join extensibility, as well as the range of motion of each body segment; (2) motor skills, which involves the strategies of response to the anteroposterior body sway (hip, ankle and knee strategy) and (3) sensorial system (visual, vestibular and proprioceptive), responsible for the control of postural balance.

Traditionally, it was believed that only the basal ganglia, cerebellum and spinal cord regulated the postural control and historically, it was believed that this type of control was basically an automated sensorimotor task. However, it was observed that both animals and humans with cortical injury (with cerebellum and brainstem preserved) showed an abnormal postural control, supporting the hypothesis that the cerebral cortex could interfere in the adjustment of postural balance in voluntary responses. Therefore, the motor system is not only involved in the production of voluntary movement, but also in their representational aspects which are accessed during the MI (“S-state).

In the context of postural control, the voluntary movement is accompanied and preceded by anticipatory postural phenomenon, because postural control is inserted in the context of the movement. Modulations on postural control can be induced by IM. The kinesthetic MI (first person) in different type of tasks, promotes major changes in postural sway when compared with the visual modality (third person). However, this influence occurs only in participants with high levels of vividness of the imagined movement, which has been correlated with increased excitability of the motor cortex and changes in spinal-reflex during the MI, suggesting that supplementary motor area (SMA) inhibits primary motor cortex (cM1) activity.

To date, there are few studies involving MI and postural control in healthy individuals. It is necessary to understand this relationship without the presence of pathologies (bias) to study the postural behavior during mental simulation of a task. The studies suggest that there is a directional specificity of the imagined movement. In other words, appears that postural displacements may occur in the direction of the imagined movement. However, this hypothesis has not yet been confirmed. After this initial step is well understood, it is important that the technique to be used with greater precision and specificity in various neurological and/or orthopedic conditions.

In the future, it is possible that the MI be used as an important component for the correction of postural control in a specific and direct way to “modular/reprogram” the postural control both in static and in dynamic, promoting changes in the basic body structure. To reach this effect, the MI may be used in the form of daily mental practice (mental training), aiming the reorganization of neural networks involved in postural control.

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