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Changes in Cortical Activity During Real and Imagined Movements: an ERP Study

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Abstract: This study aims to compare the topographic distribution of cortical activation between real and imagined movement through event-related potential (ERP). We are specifically interested in identifying, the topographic distribution of activated areas, the intensity of activated areas, and the temporal occurrence of these activations on preparation and motor response phases. Twelve healthy and right handed subjects were instructed to perform a task under real and imagery conditions. The task was performed simultaneously to electroencephalographic (EEG) recording. When compared the conditions, we found a statistically significant difference in favor of real condition revealed by performing an unpaired t-test with multiple corrections of Bonferroni, demonstrating negative activity on electrode C3 and positive activity on the electrode C4 only in motor response phase. These findings revealed similar functional connections established during real and imagery conditions, suggesting that there are common neural substrate and similar properties of functional integration shared by conditions.

Keywords: Cortical activity, event-related potential, ERP, imagined and real movements.

INTRODUCTION

Humans have the ability to generate mental images of perceptual and motor events without requiring any connection to external stimuli, a process known as motor imagery (MI) [1-3]. The MI is a mental simulation that corresponds to a dynamic state during the performance of a specific action internally reactivated in working memory in the absence of any movement [4-6].

Neuroimaging studies show a substantial similarity of the neural mechanisms underlying motor execution (ME) and MI [3-6]. However, a better comprehension of these mechanisms involved in ME and MI requires knowledge of how the brain regions activated co-interact with other regions during a particular sensorimotor task, whether real or imagined. In addition, with the technological advance achieved by neuroimaging techniques in the last two decades, it was possible to identify the brain regions that are

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