Introduction

The motor imagery (MI) or mental simulation of movements can be defined as the act of mentally play an action without executing it.1,2 Some properties observed during the execution of movements are also present during MI.1,3,7-9 because there are similarities in the mental states during execution and imagination of the same movement.1,8 With advances in neuroimaging techniques, it was possible to demonstrate the existence of overlap between the neural circuits accessed during MI and execution of the same movement.10-11 The circuits involved both in implementation and in the simulation of a task include: the supplementary motor area; The primary motor cortex (M1); The parietal cortex; basal ganglia and cerebellum.5,11-14 Some of these brain areas have shown changes in patients with complex regional pain syndrome (CRPS) during execution and MI of the same movement.15,16 The CRPS affects 1-5% of individuals with a history of trauma in the member,17-21 leading to chronic changes in different sensorimotor systems and different levels in the sensory (pain and hyperalgesia), autonomic (changes in temperature, color and sweating in the skin) and motor (weakness or loss of range of motion).20,22,24 Although their behavior is varied, the CRPS has three patterns: i) increased inflammatory response; ii) vasomotor dysfunction, and iii) adaptive changes in neural plasticity.25

The CRPS type 1 (SCR-1) is involved in similar cortical abnormalities observed in phantom pain and after a cerebrovascular stroke (CVA).26 This condition causes changes to the peripheral level (high synaptic activity, increased neurogenic inflammatory response and reduction of proprioceptive reflexes) and central (disturbances in the processing of sensorimotor cortex and body base schema),26 leading to changes in the proprioceptive reper- sentation (sensory and motor cortex) the following involved, promoting inconsistencies between motor control and sensory feedback and subsequent sensorimotor disorganization.15,27,28 Recently, the application of Program Motor Imagery (PIM) has been proposed in patients with CRPS type 1.2,29,32

Materials and Methods

This study was characterized by an integrative literature review that aims to gather, critically evaluate according to the level of evidence of the Oxford Centre for Evidence-Based Medicine (http://www.cebm.net/index.aspx?o=5653) and a synthesis result to be related to the clinical practice. For searching the data source we used the following combined keywords or not: motor imagery; complex regional pain syndrome and peripheral neuropathic pain.

Data sources, inclusion and exclusion criteria

The results of the search from each database will be detailed in Table 1.

PubMed/Medline

Among the 25 articles 10 were selected. From these, 15 studies were excluded because of their title involving M or CRPS only, but not showing changes in the processing of brain activity in both areas, sensory perception of pain (S1 and S2)15,16 and in motor areas (M1),15,33 because the pain can lead the different stages of sensorimotor disorganization.34

In this context, the purpose of this study was to investigate, by an integrative critical review, the influence of MI on the CRPS-1, correlating their evidence with the application in clinical practice.

Abstract

The motor imagery (MI) has been proposed as a treatment in the complex regional pain syndrome type 1 (CRPS-1), since it seems to promote a brain reorganization effect on sen-so-motor areas of pain perception. The aim of this paper is to investigate, through an integrative critical review, the influence of MI on the CRPS-1, correlating their evidence to clinical practice. Research in PEDro, Medline, Bireme and Google Scholar databases was conducted. Nine randomized controlled trials (level 2), 1 non-controlled clinical study (level 3), 1 case study (level 4), 1 systematic review (level 1), 2 review articles and 1 comment (level 5) were found. We can conclude that MI has shown effect in reducing pain and functionality that remains after 6 months of treatment. However, the difference between the MI strategies for CRPS-1 is unknown as well as the intensity of mental stress influences the painful response or effect of MI or other peripheral neuropathies.
the two associated in the same study. Moreover, these studies were excluded because these were about reviews and/or general treatment of CRPS, which included MI as a non-invasive or non-pharmacological treatment, citing the main works described in Supplementary Tables S1-3 of this study.

**Google Scholar**

From the 124 articles found, 5 were selected. We excluded 117 items by their title involving MI or CRPS only, but not the two associated in the same study. In addition, we found several books on one of the subjects and, therefore they were excluded from the selection.

**Searching results**

Different types of study were found in this integrative review. In Supplementary Table S1 there are 9 papers performing randomized controlled clinical trials (evidence level 2). Supplementary Table S2 presents 1 uncontrolled clinical study (Level of evidence 3) and 1 case study (evidence level 4). Finally, in Supplementary Table S3 there is the first systematic review study (evidence level 1), 2 review articles and 1 comment (evidence level 5) on the proposed topic.

**Motor imagery**

The MI may be performed using two different strategies: i) visual and ii) kinesthetic. In the first one, the participant mentally visualizes a movement being performed by him or by another person using the visual perception of the imagined movement. In the second strategy, the participant uses the kinesthetic perception of the imagined movement from somatic-motor information, involving part of the mechanisms used in the preparation and programming of the action. Neuroimaging studies have shown that while there is a common neural substrate between these two strategies (visual and kinesthetic), distinct neural circuits are activated in each of them to simulate the same task. So far, the work done with CRPS using the MI has not taken into account these two types of strategies (Supplementary Tables S1-3) and it may exist different effects between them. For example, it has been shown that the MI kinesthetic has greater sway center of pressure (CoP) compared with the visual MI in different tasks and this effect has
Reviewing and/or neural plasticity.

unmasking processes and synaptic strengthen-

under these conditions.

betes mellitus, etc.), although it is possible

neuropathic pain (post polio syndrome, dia-

ical condition. Furthermore, there is no MI

even the intensity of mental effort in this clin-

of MI modalities (visual and kinesthetic) or

simulation of the movement. However, no work

encephalic reorganization promoted by mental

is satisfactory levels of evidence (levels 1 and 2

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