



## ARTICLE

# Effects of Mirror Therapy on the upper Limb Functionality: A study on the perception of Occupational Therapists

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### ABSTRACT

With the visual illusion of the mirror, Mirror Therapy, models the primary somatosensory cortex, cortical and muscular excitability, stimulating cortical reorganization and sensorimotor recovery. Studies have shown to be effective in improving motor function in short and medium term, in activities of daily living, in visuospatial neglect and in reducing pain, especially in patients with complex regional pain syndrome. Objective: To report the perception of Occupational Therapists regarding the application of Mirror Therapy in professional practice. Specifically, what factors lead to its application, what are the effects and benefits of the technique, what are its advantages and limitations. Results: In the perception of Occupational Therapists, the Mirror Therapy technique has the following benefits: significant decrease in pain, improved sensitivity and functionality of the upper limb, unblocking movements in the affected limb, decreased phantom pain; as negative aspects: difficulties in spatial / environmental control, patient's perceptual / cognitive skills, high level of concentration / attention, absence of scientific evidence in neurological conditions. Conclusion: For the interviewed Occupational Therapists, the Mirror Therapy is a safe and useful technique to be applied in your professional practice that has been showing positive results in the functional recovery of patients, however, it lacks studies that identify the appropriate time to start its application and the explanation of an intervention protocol.

## 1. Introduction

Mirror therapy is a therapeutic intervention aimed at improving the functional movements of paretic limbs<sup>[1]</sup> that frequently causes problems with activities of daily living (ADL) such as walking, dressing or eating. It's a rehabilitation therapy in which a mirror is placed on the person's median sagittal plane, in

order to reflect the image of a limb's movements without any problems, giving the illusion that the affected limb has a normal movement<sup>[2]</sup>. Visual illusions make the patients feel as if their two hands are moving simultaneously and symmetrically. The visual illusions are activated in the cerebral hemispheres, and this activation functions as the basis of a neurological mechanism for inducing brain

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plasticity<sup>[3]</sup>.

Behind this mechanism are the mirror neurons. Mirror neurons are a class of neurons, originally discovered in the premotor cortex of monkeys, that discharge both when individuals perform a given motor act and when they observe others perform that same motor act. Ample evidence demonstrates the existence of a cortical network with the properties of mirror neurons (mirror system) in humans. This system is composed of nerve cells with visual motor properties located in the premotor cortex, primary somatosensory cortex and the lower parietal cortex. This particular type of neuron is activated during movements, by passive observation or imagination of a given action<sup>[3,4]</sup>. The human mirror system is involved in understanding others' actions and their intentions behind them and it underlies mechanisms of observational learning<sup>[4]</sup>, however, these mirror neurons are only activated if you watch an action that you can perform yourself<sup>[3,4]</sup>.

Mirror therapy was first introduced in the treatment of limb-amputated patients with phantom limb pain, and resultant reductions in pain were reported<sup>[5,6]</sup>. Studies carried out with patients with chronic stroke patients demonstrated an improvement in the function of the upper limbs and the accuracy and speed of movement<sup>[7-9]</sup>. Likewise, mirror therapy, when applied for 4 weeks in patients with acute stroke, improve their upper-extremity motor recovery and independent activity scores<sup>[10]</sup>, as well as their lower-extremity motor recovery and motor function<sup>[11]</sup>. Ramachandran, in 1995 and 1996, had also applied it in reducing pain in patients who reported phantom pain<sup>[4,6]</sup>. In short, there are several studies<sup>[10,12-15]</sup> that show that the Mirror Therapy combined with bilateral training of the upper limb, increases the feedback of visual or mental images, facilitating the motor function of the more affected upper limb, as well as sensory recovery, the quality of life, the performance of tasks in the ADL's, the level of independence, the increase of the activity of the motor cortex in cerebrovascular lesions and also the reduction of phantom pain. In short, if studies have shown that task-oriented training tends to improve the functions of the upper extremity, but mostly in terms of balance with other body parts and balance while walking. Others have claimed that such training also helps patients take care of themselves.

The aim of this study was to analyze the perception of Portuguese Occupational Therapists regarding the application of Mirror Therapy in their practice. This study is justified by the lack of scientific evidence on the effectiveness of this technique, especially on the procedures for its application and the ideal time to start the intervention. It's also important to identify the view of Occupational Therapists, on the advantages and disadvantages of its applica-

tion, as well as the population that most benefits from this technique and at what levels.

## 2. Methods

This investigation is in fact a descriptive study that will explore a qualitative approach, carried out with nine Portuguese Occupational Therapists specialized in different areas of of intervention (six are female and three are male; aged between 26 and 59 years). The data collection was made using a interview guide and a sociodemographic questionnaire. Data were analyzed using the content analysis technique [16], in an analytic-descriptive perspective. This method proves to be the most appropriate, given that it allows to verify the meaning of the participants' experience, always having a phenomenological approach to the rear.

As previously mentioned, we sought to expand and deepen and capture the experiential universe of the participants. For this, we used a semi-structured exploratory interview (oral and with audio recording for the purpose of later transcription and analysis), guided by an interview guide, previously built according to the objectives that guide this investigation. The order of approach of the different themes did not follow a rigid sequence, allowing itself to be dictated by the concerns, emphases and associations of thought of the Occupational Therapists. Throughout the interviews, according to their evolution and the interviewee, there was a need in some of them to introduce and / or eliminate some questions.

All participants provided written informed consent.

## 3. Results

The objective of the investigation was to obtain answers of Mirror Therapy usages for rehabilitation and re-education of the upper limb, applied to the clinical practice of Occupational Therapy, through the exploration of the professional experiences of the interviewees. It was found that all participants use or had used Mirror Therapy, and two of the nine participants received specific training on the technique through workshops or postgraduate studies.

It should be noted that all respondents had carried out bibliographic research on the technique, looking for scientific evidence about its practical application, its benefits, contraindications, target population and application procedures. All participants reported that they used Mirror Therapy in conjunction with other therapeutic techniques, namely, passive and / or active segment mobilization, electro-stimulation and PANat (with or without Margareth Johnstone's splints) in their therapeutic interventions, especially in individuals who suffered stroke or phan-

tom pain. With regard to the procedure for applying the technique, this is not consensus among the Occupational Therapists interviewed, varying from when its application begins and the preparatory methods they use in conjunction with it.

As main positive aspects, the interviewees referred, mainly, that the application of Mirror Therapy promotes motor and functional improvement, which promotes greater motivation and involvement of the patient in the rehabilitation process.

As less positive aspects, the interviewees point to limitations of its application, namely the demanding cognitive skills necessary to understand what is explained and requested during the application of the technique.

#### 4. Discussion

All participants reported using Mirror Therapy in conjunction with other therapeutic techniques, particularly in amputees with phantom pain and stroke patients. There is also a total agreement of the interviewees as to the fact that this technique is simple to apply and the mirror is an intervention instrument that is easy to reproduce.

According to the interviewees, Mirror Therapy, when accompanied by a conventional rehabilitation program, provides better benefits, namely in terms of sensorimotor recovery, enhancing the functionality of the upper limb<sup>[2,14]</sup>. Some Occupational Therapists also report that the application of this technique promotes pain reduction, improves performance in activities of daily life and corrects the neglect resulting from a stroke<sup>[2,6]</sup>.

Although the procedures for applying the technique are not consensual, all participants use the same type of material and the same positioning as the patient. They use a mirror (35x35cm) placed vertically, placing the hand on the affected side of the patient behind the mirror and the unaffected hand in front of the mirror<sup>[4]</sup>.

Respondents reported that attention and concentration skills are necessary and essential to perform the technique correctly. They also mentioned the need to perform it in a calm and controlled environment - which is not always possible to control, depending on the clinical context. It's necessary to maintain concentration throughout the period in which the activity is carried out in order to obtain effective functional gains. The more complex the movement sequences are, the more attention and cognitive effort is required from the patient, so, to obtain good results, it's essential that these skills are integrated<sup>[5,6,10,12]</sup>.

#### 5. Conclusion

Occupational Therapists consider mirror therapy to be a

low-cost technique, safe and easy to administer. They ensure that contraindications and side effects are few. These characteristics make mirror therapy a potential treatment option for pain control, sensorimotor re-education and the performance of activities of daily living, enhancing functional capacity. They also consider that it's a very effective technique in reducing phantom pain.

As for the application procedure, it's not consensual among the interviewees, either with regard to the beginning of its application or with regard to supporting therapy. However, everyone considers that this technique, when applied in conjunction with other therapeutic methods, is substantially more effective.

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