

The Effects of Mirror Therapy on Upper Limb after Stroke: A Mini-Review

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ABSTRACT

Stroke is one of the leading causes of disability and the improvement of upper limb function is one of the main challenges faced by them. Mirror therapy utilizes a table top mirror to create a reflection of one's arm or hand, which used to help increase movement and decrease pain in limbs. The purpose of this current article is to review and collect the evidence for the effects of mirror therapy on upper limb impairment in patients with different stroke stages. Studies suggest that applied mirror therapy alone, or coupled with different methods such as electrical stimulation, can be helpful to improve motor recovery, motor performance, motor function, and activity of daily living.

Keywords: Mirror Therapy; Stroke; Rehabilitation; Upper Limb

INTRODUCTION

Stroke is one of the globally leading causes of disability that affects various body parts and functions [1]. In total, around 17 million people per year are affected by stroke [2]. For example, in the European Union alone 1 million individuals suffer from stroke, while more than 0.7 million cases are reported in the United States every year [3].

Stroke rehabilitation is essential to improve the motor impairments and activities of daily living limitations. Most of the recovery happens in the first 3 months [4]. Around 18% of stroke patients can have full motor recovery within 6 months [3]. It is recommended to start the rehabilitation in the early stage of stroke after the stabilization of the patient's condition. The treatment can be given in the acute and post-acute stage in the outpatient departments, inpatients departments, ambulatory care units, and community therapy centers [4].

Even though several rehabilitation techniques help in the improvement of the upper limb function [5], the recovery after stroke is still a challenge for rehabilitation treatment [6]. However, the improvement of the upper limb function is

essential for patient independence and the ability to achieve daily life activities.

Mirror Therapy (MT) is a well-known rehabilitation technique, which was introduced in 1996 by Ramachandran and Rogers-Ramachandran, for treating amputees who have phantom limb pain [7]. Altschuler et al. in 1999, was the first to apply MT on stroke patients. He found that MT enhances the upper limb movement, speed, range of motion, and accuracy [8]. MT is generally considered as an acceptable, convenient, and low-cost approach compared to other treatments [9]. The main setup of MT consists of the patient sitting near the mirror, which is located diagonally along the body level separating the unaffected and the affected limb. The affected part is positioned behind the mirror such that the patient is only able to observe the healthy limb reflection on mirror [10]. With this setup, the patient is asked to remove various objects wore around unaffected limb such as a ring, a watch, a ribbon, etc. This activity facilitates the illusion to happen [11]. In general, it was commonly found that the total duration was 6 weeks of treatment. A typical session time ranged from 30 to 90 minutes per day [6,9,12,13].

MT has been applied in patients with different diseases such as phantom limb pain [14], complex regional pain syndrome [15],

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cerebral palsy [16], and stroke patients with different severity stages acute, subacute and chronic stroke [17]. It can be used solely [18] or combined with other modalities such as electrical stimulation [13]. The main concept of MT is to provide visual feedback from watching the reflection of the unaffected limb on the mirror, leading to create a visual illusion [11]. It is believed that MT could activate the somatosensory cortex, prefrontal cortex, supplemental motor area, cingulate cortex, and superior temporal gyrus [19,20]. Besides, MT stimulates mirror neuron that is found in the premotor cortex, inferior frontal gyrus, and inferior parietal lobe, which could lead to enhance the upper limb motor function in stroke patients [21]. Nonetheless, the exact mechanism for the MT has not yet been fully understood [9].

MIRROR THERAPY ON CHRONIC STROKE PATIENTS

Many studies have investigated the effects of MT on chronic stroke patients with mild, moderate or severe upper limb motor function impairments. For example, Arya et al. [11] evaluated the effectiveness of MT on upper limb function and concluded that the usage of MT can improve the upper limb motor function. Another study by Harmsenin et al. [22] reported positive effects of MT with based action observation in enhancing the movement time recovery.

Using the same treatment, Kim et al. [23] evaluated the effects of applying MT course on upper limb hemiparesis. At the end of the therapy course, they found a significant improvement in the upper limb manipulation function, grasp, and pinch. Colomer et al. [12] and Park et al. [24] agreed that adding MT to the rehabilitation treatment will enhance motor recovery, motor performance, hand function and will improve the activities of daily life. In another work, Arya et al. [25] concluded that MT can improve coordination, muscle strength motor recovery, and dexterity in the healthy hand.

MIRROR THERAPY ON SUBACUTE STROKE PATIENTS

In recent years, few studies investigated the effect of simple movement MT or Task-Based Mirror Therapy (TBMT) in the management and treatment of the upper limb motor function impairment on subacute stroke patients. For instance, Gurbuz et al. [26] and Mirela Cristina et al. [9], through randomized clinical trials, analyzed the effectiveness of adding MT to the rehabilitation treatment on subacute stroke patients having upper limb hemiparesis. These studies found a positive effect in motor recovery, motor function, activities of daily living for the patients who treated with MT compared to the other group who only received conventional therapy.

In addition, Lim et al. [18] concluded that adding MT to conventional therapy can provide a significant improvement in the motor function and activities of daily life. A study done by Samuelkamaleshkumar et al. [19] examined the effect of MT on stroke patients and concluded that MT can enhance motor recovery, motor function, and gross manual hand dexterity. Moreover, Park et al. [27] evaluated the effects of applying TBMT on the upper limb hemiparesis on subacute stroke patients. This study showed a great significant improvement of

self-care, motor function and activities of daily life in the TBMT group in comparison to the control group.

MIRROR THERAPY ON ACUTE STROKE PATIENTS

In the recent two reports, Antoniotti et al. [28] and Yeldan et al. [29] had examined the effects of MT on upper limb hemiparesis on acute stroke patients. They both separately concluded that the impact of MT on upper limb motor function was limited. On the other hand, Pandian et al. [30] conducted a study aiming to evaluate the effects of MT on unilateral neglect in acute stroke patients. During the study, a significant improvement was observed in the MT group. Concluding that MT is a great approach to improve and reduce unilateral neglect.

MIRROR THERAPY COMBINED WITH DIFFERENT TECHNIQUES

Combined therapy on chronic stroke patients

Several studies compared the effectiveness of MT coupled with other techniques on the upper limb motor function on chronic stroke patients. Paik et al. [31] suggested that MT can be beneficial in enhancing the upper limb motor function when coupled with electrical stimulation.

Similarly, Kim et al. [32] reported that MT can be useful in improving the activities of daily living and motor function once associated with Biofeedback Functional Electrical Stimulation (BFES). While in another study, Lee et al. [13] found that applying MT together with mesh glove on the upper limb hemiparesis would improve the muscular properties of the patients and motor function recovery.

Earlier, Beom et al. [33] demonstrated that adding robotic to MT can be a good way to improve the upper limb motor function after stroke. Likewise, Nam et al. [34] concluded that robotic MT is a good treatment to improve motor function and reduce unilateral neglect.

Combined therapy on subacute stroke patients

In recent years, various studies concluded that MT coupled with other techniques can positively affect the upper limb motor function. For instance, Kim et al. [35] demonstrated the positive effects of MT combined with FES on upper limb motor function and motor recovery in subacute stroke patients. In a separate study, Schick et al. [36] proposed that MT combined with multichannel EMG-triggered electrical stimulation on severe arm hemiparesis in subacute stroke patients can improve motor performance, motor recovery, and activities of daily life.

CONCLUSION

In summary of this review, studies have indicated that MT is effective in treating the upper limb impairment in patients with chronic and subacute stroke. On the other hand, there still not enough evidence published to assure its effectiveness on acute stroke patients. MT whether solely or combined with other rehabilitation treatment methods were shown to have positives impact in enhancing motor performance, motor recovery, and the activities of daily life for upper limb impairment after stroke.

The purpose of this review is to help both researchers and rehabilitation teams in understanding the effects of MT on upper limb motor function impairment on stroke patients as well as the manner of applying this method on the patients to get a better recovery.

CONFLICT OF INTEREST

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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