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EFFECT OF MIRROR THERAPY THROUGH FUNCTIONAL ACTIVITIES TO IMPROVE MOVEMENT AS CENTRAL POST-STROKE PAIN TREATMENT: A CASE REPORT

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Abstract

Background: Stroke patients generally have disorders related to decreased functionality, motor disturbances being the most common. One symptom of stroke is sudden weakness of one side of the body on the face, arms and legs. Central post-stroke pain is a condition of central neuropathic pain arising directly from lesions of the cerebrovascular central somatosensory nervous system. Mirror therapy is a non-pharmacological therapy in the form of imaging of the limbs, where a mirror medium is used to convey visual stimulation to the brain through observing body parts of patients who are not disabled while doing a series of movements. Mirror therapy helps in reducing disability in the limbs of stroke patients and as a treatment. for post-stroke central pain, thereby helping to improve functional limbs and shorten the rehabilitation period.
Summary of case: A 54-year-old man with painful spastic left hand has been diagnosed with infarct stroke in the right thalamus 2 years ago. Mirror therapy has been done for two weeks, precisely six days per week with a duration about 30 minutes. Mirror therapy is done by using a mirror media that is placed on both arms and hands of the patient symmetrically and the patient observes the reflection of a healthy limb through flexion, extension, finger counts, and grasping objects. Visual Analogue Scale (VAS Score) is used to measure the level of pain before and after mirror therapy. After one month of mirror therapy the patient experienced an increase in motor function and decrease in pain scale.
Conclusion: Mirror therapy is a promising non-pharmacological method in reducing disability and central pain after stroke.

Keyword : Stroke, central post-stroke pain, mirror therapy.

INTRODUCTION

Stroke or CVA (Cerebral Vascular Accident) is an acute vascular neurological dysfunction caused by disruption of blood flow to the focal area of the brain. Despite having had stroke therapy, sequelae can lead to disability, and global involvement significantly interferes with daily activities/ Activities of Daily Living (ADLs). Stroke causes a decrease in limb control and can also affect perceptions that sometimes cause pain (1,2).

Pain is a complaint that is often found in stroke patients, it is noted that about 15-49% of pain can occur within 2 years after a stroke. Post-stroke central pain (NSPS) is central neuropathic pain after a stroke. Central pain after stroke is characterized by pain that arises constantly or intermittently. Blockage of blood vessels in the thalamus region can cause characteristic pain. The incidence of NSPS can be found in 1 out of every 6 patients with vascular lesions in the thalamus. Hyperexcitability of damaged thalamus or cortex neurons is considered to be one of the pathophysiological mechanisms underlying NSPS (3,4).

The World Health Organization (WHO) recommends the use of safe and inexpensive rehabilitation techniques that make it easier to apply to stroke patients with disabilities. One such therapy is mirror therapy. Mirror therapy tends to be easy to do, namely by using a mirror media that is placed on one side of the patient's body so that the patient can observe the reflection of a healthy limb (5,6).

Mirror therapy is a form of imaging of the limbs that is a mirror medium used to convey visual stimulation to the brain through observing the body parts of patients who are not disabled while performing a series of movements (7,8). Mirror therapy techniques utilize mirror illusions created by limbb movements that are considered as limbs that experience paresis. The nerve cells responsible for regulating movement and the neuron system help in rearranging the damaged brain and improve motor control (9,10). Mirror neurons are activated during the observation of movements through mirror therapy. Mirror therapy helps in reducing disability in the limbs of stroke patients, thus helping to improve functional limbs and shortening the rehabilitation period (11).

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Mirror therapy is also very simple which can also be practiced at home with the help of family or caregivers who can ease the burden of stroke health care costs in the long run, which improves the quality of life. Several research studies have shown the effectiveness of mirror therapy among stroke patients.

CASE PRESENTATION

Case Description

A male patient aged 50 years, left hand weakness due to stroke of subacute infarction in 2017 in the right thalamus, capsula interna limb posterior left genu, chronic infarction in left semi ovale center, left right corona radiate, left lateral periventricular cornu, nucleus Left lentiformis and senile brain atrophy. On head CT scan without contrast showed visible borderline hypodense lesions starting firmly in the right thalamus, left posterior internal limbu capsules, left border hypodense lesions firmly in the left semiovale center, left right corona radiate, left anterior periventricellateral cornu, left nucleus lentiformis (Figure 1).

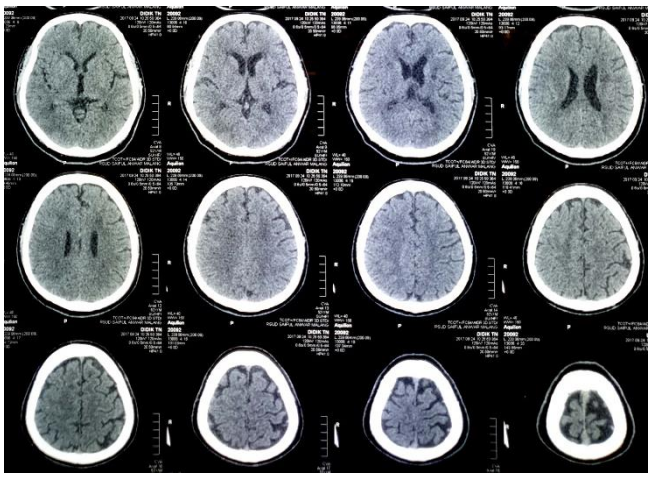

Figure 1. Head CT Scan, Brain Window without Contrast

Patients routinely control to the neurologist and get stroke and hypertension medication, the patient has not done a daily physiotherapy program for 2 years as an outpatient, which causes a suboptimal recovery in motor power. Two years after being diagnosed the patient complained of pain in extremities with complaints of CPSP syndrome, the patient experienced persistent difficulty in the functional use of the left side of his body, especially the upper hand when grasping. The patient is quite independent in daily life activities (Functional Independence Measure = 120), uses a cane to walk, and requires additional time for self-care. Obtained allodynia and persistent dysesthesia in the left upper limb and left side of the face. The patient feels pain with a light touch on the left hand. Patients routinely consume Pregabalin to relieve pain (patients do not remember the dosage) but complaints only briefly diminish and recur. At the time of treatment the patient does not take medication. Muscle strength was measured using the Medical Research Council (MRC) Scale for Muscle Strength, showing weakness in the left side (grade 4 of 5: Muscle strength is reduced but muscle contraction can still move against resistance) assessing shoulder strength, elbow flexors, wrist extensors, hip extensors, knee extensors, knee flexions and leg flexions (12). The patient is able to make leg movements and move each left hand finger singly.

INTERVENTION

After several MT training sessions, the patient attains the ability to maintain a standing position on the left leg for several minutes without using a stick. During one session that is targeted to improve upper limb motion, patients can do the exercise with visual feedback provided by the mirror. After this exercise, the patient shows good positive sensations on the left arm and wrist. The patient underwent MT training for one month to reduce pain in the upper limb. The patient completed 4 consecutive weeks of MT training for five days a week with a duration of 30 minutes each session. In each session, he was asked to make bilateral symmetrical movements of the upper limb while looking at reflections reflected by an upright mirror. The movements requested are: flexing the wrist extension and opening and closing the hand, grasping a small ball, and moving a small object 15 cm (Figure 2). These movements are carried out randomly. Each movement is performed at a spontaneous pace (about one movement every 3 seconds). The patient is given rest for 5 minutes and to mobilize the left arm and hand without a mirror. During exercise, the patient is supervised by doctor. Patients are given instructions, corrections, or encouragement during MT training.

OUTCOME

Pain severity was assessed by the Visual Analogue Scale (VAS 0-10 cm): patients were asked to describe pain intensity with a score of 0-10 indicating "0 = no pain" and "10 = worst pain imaginable". During therapy the patient continues to take painkillers given by the neurologist at the same dose. VAS is used to assess the severity of pain in the extremities in two separate conditions: before and after MT is given, ie at rest and during maximal contraction of the left hand.

RESULT

Before starting MT, the patient was stable for functional use of the upper limb and pain (Table 1). The patient shows a reduction in pain intensity before the MT with VAS Score of 6 and 5 points during maximal contraction through gripping and moving small objects in the first week. The patient reported a reduction in pain intensity which was described as "a significant change". Reduction of the VAS score for left hand pain also occurs namely 4 points before the MT is done to 3 points during maximum contraction. Hand strength and dexterity do not show relevant variations after treatment, but the duration of arm and wrist movements look better after 2 weeks of MT. The patient felt quite satisfied with the reduction in pain after MT and spontaneously decided to continue training at home after 1 month of therapy.

Table 1. Pain intensity with VAS score before and after mirror therapy

Activities	Example	Session	Duration	Pre MT	Post MT
Range of Motion (ROM) Exercise and Object Manipulation	• Pronation and supination of the forearm • Wrist flexion and extension • Hold hands • Metacarpophalangeal abduction and adduction • Opposition of the thumb • Move objects	Week I (5 days)	30 minutes/day	6	5
		Week II (5 days)	30 minutes/day	6	5
		Week III (5 days)	30 minutes/day	5	4
		Week IV (5 days)	30 minutes/day	4	3

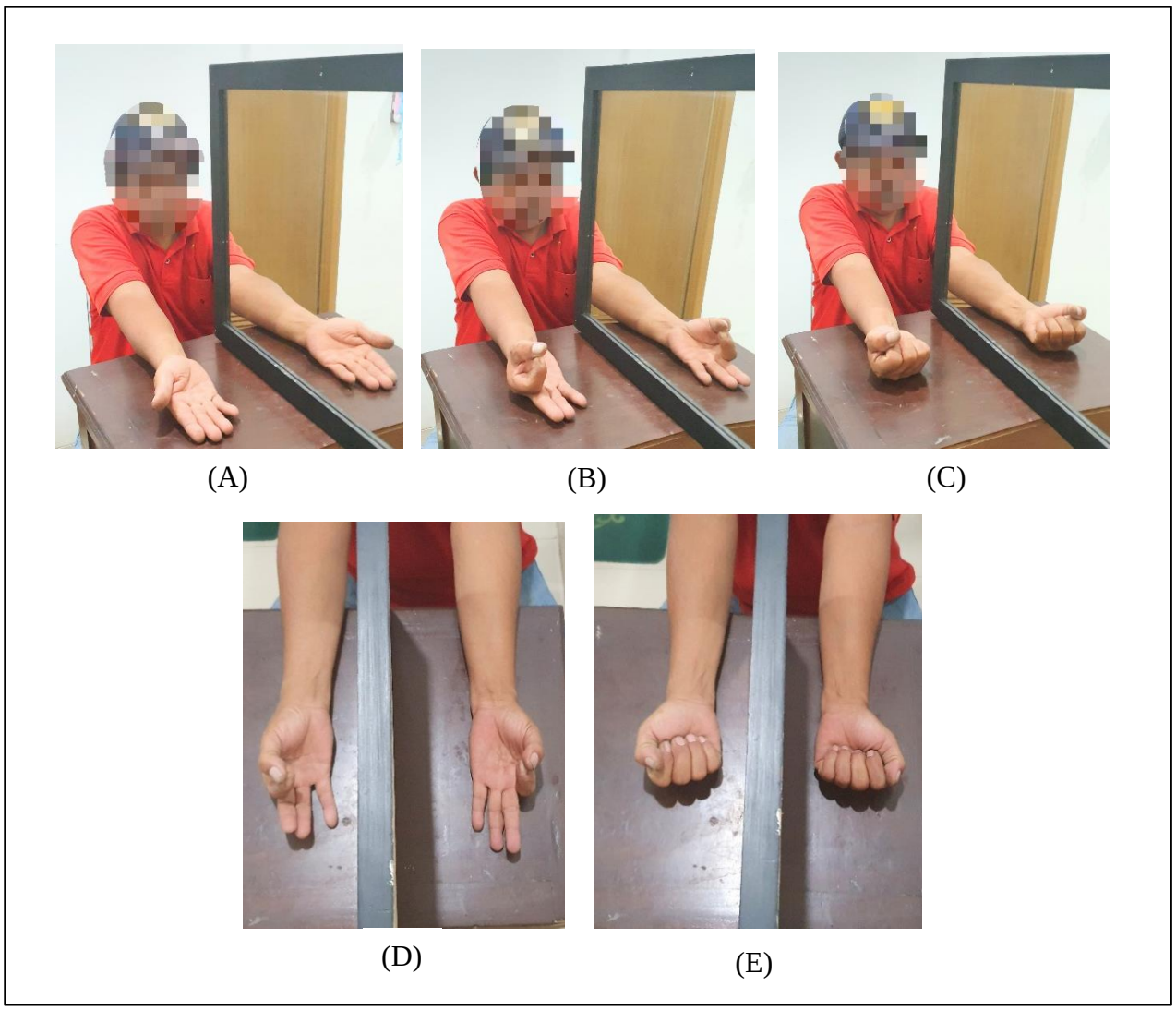

Figure 2. Mirror Therapy Method: Symmetrical bilateral movements in the upper limb MT while looking at reflections reflected by an upright mirror.

DISCUSSION

This case report shows the application of MT in the upper limb for the reduction of CPSP in patients with thalamus infarction strokes for the past 2 years. The findings from the literature support the use of MT at least as an additional rehabilitation intervention to improve motor function in patients with stroke (13). Through proprioceptive input by visual information or sensorimotor nerve plasticity induced by MT can help motor recovery. The application of MT in people with strokes with post-stroke central pain shows a significant effect in reducing the intensity of pain (13,14). In these patients, MT was used with the aim of reducing the occurrence of NSPS (14).

The pathophysiology of NSPS is still unclear and different mechanisms involving the thalamus are thought to underlie this phenomenon including sensory loss, medial disinhibition (causing hypersensitivity), and abnormalities in spinothalamic function (causing a decrease or increase in temperature sensation, especially cold) (15,16). This mechanism usually exacerbated by excitotoxic and inflammatory changes caused by stroke lesions, resulting in the perception of pain even if it does not get excessive stimulation and result in chronic pain (17). In addition,

altered balance in sensory motor can underlie central pain. The thalamus lesion has been identified as one of the most common causes of NSPS (18,19). MT can optimize the altered balance between ispilesional motor sensory activation and contralesi caused by maladaptive reorganization of the somatocene cortex, thereby reducing pain perception.19 Thus, in patients this, after 1 month of MT decreased pain intensity for hands and arms, pain perception changed. The brain will match visual and kinesthetic input during movement, linking what is seen to what is felt (20). This shows that the MT combination of visual illusions and movements will direct the CNS to achieve "sensory congruence", which in turn will contribute to a reduction in taste pain. Although the patient is aware of sensory illusions does not reduce the CNS efforts to achieve sensory coherence between visual information and perception (18,20-22).

The patient is able to effectively add MT to his normal daily routine, and he is able to run the program with minimal caregiver support. Patients can do light and independent activities without assistance such as eating and drinking, buttoning up clothes. This information indicates increased activity and may be useful for perfecting maintenance protocols for subsequent MT use. Patients showed improvement before post intervention at all included outcome steps. These results are consistent with previous results showing that MT is effective in reducing sensory disturbance and improving ADL function after stroke (19,20). Our results show that MT has a greater impact on pain reduction than on sensory function (21,23). Thus, reduction in pain intensity in patients cause increased use of arms and hands for ADL. Further research is needed to determine whether MT is more effective in reducing certain types of disorders after stroke and whether the reduction in implications produced by MT (ie, reduction in pain and sensorimotor function) directly influences increased activity and participation.

CONCLUSION

As a conclusion, this case report shows that MT post stroke can influence the perception of pain due to CNS lesions and can be considered as an additional approach to reduce pain intensity in patients with NSPS.

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CONFLICT OF INTEREST

None.

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