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To Compare Mental Practice with Motor Imagery and Mirror Therapy on Hand Function in Stroke Patients

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Abstract: ***Background & Objective: To compare mental practice with motor imagery and mirror therapy on hand function in stroke patients. Method: 24 patients of stroke of different age and gender were recruited and subjects who met the inclusion criteria were randomly allocated into 2 groups: Group A- patients undergone Motor Imagery& Group B- patients undergone Mirror Therapy. Pre- and post assessment of hand function assessed using fuglmeyer scale and Action Research Arm Test (ARAT).Patients diagnosed with CVA, age between 41-65 years, medically stable after acute CVA, both male and female were included. Patients with upper limb amputation, upper limb fracture, with artificial joints, having severe cognitive impairments, brain injury and surgery, diagnosed with any other neurological disorders were excluded. Result: In Group-A (Motor Imagery) and Group-B (Mirror Therapy), all data was expressed as mean ±, SD and was statistically analyzed using paired 't' test and independent 't' test to determine the statistical difference among the parameters at 0.5% level of significance. Statistical data of FMA and ARAT of both the groups values showing that, Group-A & Group-B both are effective with p<0.05; i.e. 95% of significance. Conclusion: This study concluded that Mirror Therapy is more effective in improving hand function in stroke patients than Motor Imagery.***

Keywords: Stroke, Motor Imagery, Mirror Therapy, FMA, ARAT, hand function

1. Introduction

Stroke is a great common neurological disorder, representing a major cause of disability[1]. It is considered as a significant health problem, which needs an unremitting and wide-ranging rehabilitation. Stroke is also known as ''cerebral vascular accident", "brain attack" or "apoplexy".[2] According to WHO Stroke is defined as "acute onset of neurological dysfunction due to abnormality in cerebral circulation with resultant signs and symptoms that corresponds to involvement of focal area of brain lasting more than 24 hours"[3]

The primary pathophysiology of stroke is an underlying heart or blood vessel disease[4]. The secondary manifestations in the brain are the result of one or more of these underlying diseases or risk factors[5]. The primary pathologies include hypertension, atherosclerosis leading to coronary artery disease, dyslipidemia, heart disease and hyperlipidemia. After stroke, many individuals have chronic unilateral motor dysfunction in the upper extremity that severely limits their functional movement control [13] Voluntary movement control is typically impaired after a stroke. Movement control of the body on the contralateral side of the brain lesion proceeds through stage of recovery in which the sensory and motor function are often re-established abnormally[14]. In the upper extremity, after a period of flaccidity, a common course of recovery includes the development of an uncontrolled flexion synergy. This pathological synergy is observed in the hemi paretic limb during efforts to use the arm for functional tasks. Individuals with this uncontrolled flexion synergy have great difficulty isolating joint movements out of synergy. Indeed, control of wrist and finger extensors is a challenging aspect of upper extremity recovery[15]

Mental imagery is an active process that combines all six senses: visual, auditory, tactile, kinesthetic, olfactory, and gustatory[17]. Motor imagery, a component of mental imagery, is associated with a specific movement produced by the internal reproduction of motor action without motor output [17,18]. Mental practice (MP) involves motor imagery and includes repetitive imagination of a physical activity with the intention of performing that activity or improving performance[17,19]. MP allows an individual to perform tasks repeatedly without physical exhaustion or any risk to safety[20] . The application of MP in stroke patients was reported to activate the cerebral and cerebellar sensorimotor structures repeatedly [21], and similar results were obtained when the actual tasks were practiced, according to a study involving positron emission tomography[22]

Mirror therapy is a relatively new intervention initially developed for the treatment of phantom limb pain.[26] It was introduced to stroke rehabilitation in the late 1990s.[27] In contrast to most interventions working with sensorimotor training strategies, mirror therapy focuses on visual input. While moving the unimpaired arm an inverse reflection is created by a mirror which is positioned between the two arms. The reflection of the unimpaired arm creates a visual illusion of enhanced movement capability of the impaired arm. A Systematic Cochrane Review showed that mirror therapy after stroke is effective in improving short- and middle-term motor function, activities of daily living and in reducing pain, especially in patients with a complex regional pain syndrome.[28] One study showed positive effects of mirror therapy on visuospatial neglect after stroke.[29] However, no definitive conclusions could be drawn about the success of mirror therapy relative to severity of motor impairment or time since stroke onset. One study found mirror therapy to be effective only in patients who were paralysed in the early stages post stroke.[29]

2. Methodology

Study Design: Comparative study
Sample Design: Selective sampling
Study Population: Study was done on patients having stroke and medically stable post stroke**.**
Sample Size: The study was done on twenty four (n=24) patients
Study Setting: From various OPDs in Vadodara
Study Duration: 4 weeks
Treatment duration: 20 min per session5 times per week

Sampling Criteria:
Subjects for study were selected based on following criteria:

Inclusion Criteria:
- Patients diagnosed with CVA
- Both male & female
- Age 41 to 65
- Medically stable after acute CVA

Exclusion Criteria:
- Patients with upper limb amputation
- Patients with upper limb fracture
- Patients diagnosed with any other neurological disorders
- Patients having severe cognitive impairments
- Patients with artificial joints
- Patients with brain injury and surgery

Data Analysis
In present study 24 subjects with age group of 41-75 years were taken and divided into two groups. Group A(Motor Imagery) and Group B(Mirror Therapy).The data obtained in both groups are as follows. Statistical Package for Social Science (SPSS) version 17 was used for data analysis.

3. Discussion

A comparative study was conducted on 24 patients (16 male, 8 female) within the age group of 41-75 to see which therapy is more effective, mirror therapy or mental practice with motor imagery on hand function in stroke patients. Comparison of Motor Imagery and Mirror therapy was done in which, patients of Mirror Therapy group showed greater improvement than Motor Imagery as measured by ARAT and FMA. Some authors suggested that mirror therapy related to motor imagery and that the mirror creates visual feedback of successful performance of the imagined action with impaired limb; however, motor imagery itself have proven to be potentially beneficial in the rehabilitation of hemiparesis. As a possible alternative explanation, a recent fMRI study by Matthys et al., showed some evidence for MNS activation by reporting increased activation within superior temporal sulcus [31] This supports the hypothesis that the effect of Mirror Therapy might be due to activation of mirror neuron system, since the observation of movements activates the motor areas in the affected hemisphere, facilitating the excitability of M1 area. Moreover, in the only imaging experiment on inverted visual feedback, lateralized activations were not recorded in the premotor area, but in occipital and posterior parietal regions, assuming that the precuneus region (area v6), rather than superior temporal sulcus, plays a decisive role. This area belongs to neural network supporting the mental representation of the self, suggesting that premotor areas are activated bilaterally, without lateralization because of the observed body side. Thus, the beneficial effect of Mirror Therapy is possibly mediated by the visual illusion that actions carried out by one self are performed normally.A previous study on virtual movement training and mirror therapy of the upper-limb in chronic stroke patients showed an improvement of more than 33% in upper-limb FMA items, which supports our results that mirror therapy is effective in promoting upper-limb motor recovery. Used Transcranial Magnetic Stimulation (TMS) to look at excitability of the motor cortex ipsilateral to a moving hand in Motor Activity Log (MAL) subjects [30]. They studied four conditions: (i) subjects watching the hand they were moving; (ii) subjects watching their inactive hand; (iii) subjects watching a marked position between the moving and inactive hand; and (iv) subjects watching the reflection of the moving hand in a plane reflecting mirror. They found a significant increase in motor cortex excitability in the mirror viewing condition compared with the other conditions consistent with the mirror reflection exciting the motor cortex corresponding to the reflection of the moving hand. Suggested that the mirror illusion of a normal movement of the affected hand may substitute for decreased proprioceptive information, thereby helping to recruit the premotor cortex and assisting rehabilitation through an intimate connection between visual input and premotor areas .This mirror illusion was absent in conventional group of our study and therefore showed less improvement as compared to experimental. Results similar to the present study were reported by GunesYavuzer et al . They found that hand function improved more after MT in addition to a conventional rehabilitation program as compared with a conventional treatment immediately after 4 weeks of treatment.

4. Conclusion

This study concluded that Mirror Therapy is more effective in improving hand function in stroke patients than Motor Imagery.

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