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Effectiveness of conventional therapy versus conventional therapy combined with motor imagery and mirror therapy in improving upper extremity motor function in left hemiparetic patients: a comparative study

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فعالية العلاج التقليدي مقارنةً العلاج التقليدي المدمج مع التصور الحركي والعلاج بالمرآة في تحسين الوظيفة الحركية للطرف العلوي لدى مرضى الشلل النصفي الأيسر: دراسة مقارنة

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Abstract:
The aim for the study is to compare the effectiveness of conventional physiotherapy versus conventional physiotherapy combined along with motor imagery and mirror therapy in improving the motor functions in upper extremity in left hemiparetic patients. The results of the study would help the patient and the therapist to incorporate these new techniques to improve the motor functions of the affected upper extremity. This study was experimental in nature. 20 samples were selected by using simple random sampling procedure and were divided into two equal groups, experimental group A – n=10 subjects and experimental group B - n=10 subjects. Pre test scores of fugl Meyer upper extremity motor performance scale for both the groups were taken on the first day. After the pretest assessment, the group A received conventional physiotherapy for period of 6 weeks and group B received mental stimulation exercises

along with conventional physiotherapy for a period of 6 weeks. Posttest were taken after the treatment for both the group in a similar fashion as that of the pretest assessment. The collected data were subjected to paired t test individually for the group I and group II. The 't' calculated value of the paired t test for motor performance of upper extremity of upper extremity for group I who underwent conventional therapy alone and group II who underwent conventional therapy along with motor imagery and mirror therapy were 5.552 and 14.023 respectively. The't' table value for 9 degrees of freedom at 5% level of significance was found to be 2.262 respectively. The't' calculated values of paired't' test were matched with't' table values. It was found that't' calculated is > table value for both the groups. After the paired't' test the data were subjected to independent 't' test to analyze any difference in improvement between group I and group II. The't' calculated value of independent't' test Upper extremity motor performance was found to be 7.056 respectively. The't' table value for 18 degree of freedom at 5 % level of significance was found to be 2.101 respectively. The't' calculated value value of independent't' test was matched with't' table value. It was found that't' calculated value >'t' table value. The outcome of statistical analysis shows the significant effects of both the treatment protocols in experimental group I and group II and the significant difference between the improvements in favor of experimental group II. The result of the study conclude that conventional therapy combined with mental imagery and mirror therapy is better than conventional therapy alone in improving upper extremity motor functions in left hemiparetic patients.

Keyword: Physiotherapy, Thermotherapy, Exercise Therapy, Breast Cancer, Physical Rehabilitation, Shoulder Joint Function.

الملخص:

تهدف هذه الدراسة إلى مقارنة فعالية العلاج الطبيعي التقليدي مقابل العلاج الطبيعي التقليدي المُدمج مع التصور الحركي (الصور الذهنية) والعلاج بالمرآة في تحسين الوظائف الحركية للطرف العلوي لدى مرضى الشلل النصفي الأيسر. ومن شأن نتائج الدراسة أن تساعد المريض والمعالج على دمج هذه التقنيات الجديدة لتحسين الوظائف الحركية للطرف العلوي المصاب. اعتمدت هذه الدراسة منهجًا تجريبيًا، حيث تم اختيار 20 عينة بطريقة العينة العشوائية البسيطة، وقُسِّمت إلى مجموعتين متساويتين: المجموعة التجريبية (أ) – عددها 10 أفراد، والمجموعة التجريبية (ب) – عددها 10 أفراد. تم قياس الدرجات القبلية لمقياس فوجل-ماير للأداء الحركي للطرف العلوي لكلا المجموعتين في اليوم الأول. وبعد التقييم القبلي، تلقت المجموعة (أ) العلاج الطبيعي التقليدي لمدة 6 أسابيع، بينما تلقت المجموعة (ب) تمارين التحفيز الذهني (التصور الحركي) إلى جانب العلاج الطبيعي التقليدي لمدة 6 أسابيع. ثم أُجري التقييم البعدي بعد انتهاء العلاج لكلا المجموعتين بنفس طريقة التقييم القبلي. خضعت البيانات المجمعة لاختبار "ت" المقترن (Paired t-test) لكل مجموعة على حدة. كانت قيمة "ت" المحسوبة لاختبار "ت" المقترن للأداء الحركي للطرف العلوي للمجموعة الأولى (العلاج التقليدي فقط) تساوي 5.552، وللمجموعة الثانية (العلاج التقليدي + التصور الحركي والعلاج بالمرآة) تساوي 14.023. أما قيمة "ت" الجدولية عند 9 درجات حرية ومستوى دلالة 5% فكانت 2.262. وبمقارنة قيم "ت" المحسوبة بالقيم الجدولية، وُجد أن القيم المحسوبة أكبر من القيم الجدولية لكلا المجموعتين. بعد اختبار "ت" المقترن، خضعت البيانات لاختبار "ت" المستقل(Independent t-test) لتحليل الفرق في التحسن بين المجموعتين. كانت قيمة "ت" المحسوبة للأداء الحركي للطرف العلوي تساوي 7.056، بينما كانت القيمة الجدولية عند 18 درجة حرية ومستوى دلالة 5% تساوي 2.101، ووجد أن القيمة المحسوبة أكبر من القيمة الجدولية. تشير نتائج التحليل الإحصائي إلى وجود تأثيرات معنوية لكلا البروتوكولين العلاجيين في المجموعتين التجريبيتين، وإلى وجود فرق معنوي في التحسن لصالح المجموعة التجريبية الثانية. خلصت الدراسة إلى أن العلاج الطبيعي التقليدي المُدمج مع التصور الحركي والعلاج بالمرآة أفضل من العلاج الطبيعي التقليدي وحده في تحسين الوظائف الحركية للطرف العلوي لدى مرضى الشلل النصفي الأيسر.

الكلمات المفتاحية: العلاج الطبيعي، العلاج الحراري، التمارين العلاجية، سرطان الثدي، إعادة التأهيل البدني، وظائف مفصل الكتف.

Introduction:

Stroke is defined as *"*a condition characterized by rapidly developing symptoms and signs of a focal brain lesion, with symptoms lasting for more than 24 hours or leading to death, with no apparent cause other than that of vascular origin". (World Health Organization). In India, up to 80% of stroke

patients was ischemic in nature. (The Indian Collaborative Acute Stroke Study (ICASS)). Ischemic stroke is the most common form, accounting for more than two-thirds of all stroke events (Bronner et al 1995). A recent community survey in the eastern Indian city of Kolkata showed the prevalence rate of stroke to be 545 per 100000 populations. The average annual incidence rate of stroke in the same study was 145 per 1,00, 000 persons per year. Stroke burden in India has been rising in the last few decades, in contrast to developed countries, where stroke prevalence has decreased or plateaued. The Conventional neurological rehabilitation follows the inhibitory and facilitatory techniques to reduce the impairment and minimize the disability. In conventional physiotherapy loss of recovery is reflected by activity limitations which may cause therapists and patients to switch too quickly to the teaching of compensatory techniques using the “un affected” upper limb and stop working on improving the motor function in the “affected limb”. This, in turn may lead to “learned nonuse” in which repeated failed attempts to use the affected arm can lead to negative reinforcements in the use of that arm. (Classen. J et al., 1998).

Motor imagery exercises are exercises in which the patient imagines executing the movement they are going to do but does not actually do the movement. This exercise helps create preparedness for doing the intended movement. Mirror therapy, an innovative method, used to augment standard neuromuscular techniques that focus specifically on physical practice of the affected limb which provides the patient an opportunity to experience his or her impaired limb completing successful movements by watching the movement of the healthy limb in the mirror, and the striking effect vision can have on movements.

Mental imagery exercises and mirror therapy exercises when included along with the conventional therapy will have a central effect in improving the movement of the affected upper limb after stroke which helps the physiotherapists to extend their knowledge and incorporating them in improving motor function of upper extremity in addition to the current conventional therapy. Rock and victor, et al.,(1964) Demonstrated that vision can dominate over sensory modalities. Gandevia and Rothwill, et al., (1987) showed that “concentrating on one hand without activating it increased the effort of subthrushold magnetic stimulation of the cortical area corresponding to that muscle (and not other muscles)”. Thus, there is a selective enhancement of cortical responsiveness during imagery or related process. Warner L, Mc Neill, et al., (1988) explored the feasibility of using mental imagery as adjunctive techniques in physical therapy. He concluded that mental imagery has the potential to be viable techinique for physical therapy. Yue and Cole, et al., (1992) Concludes that increase in muscle strength following mental training did not primarily result from neural changes at the execution level, but at a higher planning and programming levels of the motor system. The altered programs in turn would achieve strength gains by acting on the spinal circuitry.

M. Jeannerod, et al., (1995) States that many neural mechanisms are activated during motor imagery, as revealed by a sharp increase in tendinous reflexes in the limb imagined to move, and be vegetative changes which correlate with the level of mental effort. At the cortical level, a specific pattern of activation, that closely resembles that of activation execution, is observed in areas devoted to motor control. This activation might be a substrate for the effect of mental training. Roth Gangel AS, et al., (1996) concluded that movement using mirror visual feedback has significant increase in cerebral blood flow. Further he also states that stroke patients recruited a cortico sub cortical attention network in the right affected hemisphere. Nicola Smania et al., (1997) concluded that Visio motor imagery training ameliorated the deficit in performance related to neglect in his patients.Medical Tribune News Service (1998) reported that patients who have problems mobbing an arm or leg months after stroke appear to be helped by watching the movement of a healthy limb in a mirror.

Eric Altschuler, et al., (1999) Presented his findings that people affected by strokes “have problems with sensory feedback (involved) with the position sense of their muscles”. The mirror therapy apparently replaces “that absent or deficient position with vision”. Cathrin buterfisch, et al.,(1999) Emphasizes the importance of frequent movement repetition for the motor rehabilitation of the centrally paretic hand and challenge conventional physiotherapeutic strategies that focus on spasticity reduction instead of early initiation of active movements. K. Sathian, et al., (2000) In his

study reports successful application of “mirror therapy” in post stroke rehabilitation with poor functional use of an upper extremity, due to mainly to somato sensory deficits. Mirror therapy facilitated employment of a motor copy strategy (bimanual movements) and later progression to “forced use” of the affected arm. The end result was increased use of the affected upper limb. Stephen j Page, et al., (2001) Indicates that massed use of the affected arm results in cortical reorganizations and correlative functional improvements. He also stated that mental practice leads to wide spread activation of neural and muscular mechanism as if the arm were actually being used.

WR Staines, et al., (2001) In his study found out that bilateral movements enhanced activation in the primary motor cortex (MI) of the affected hemisphere with unilateral paretic hand movement. Eiichi Naito, et al.,(2002) Concluded that kinesthetic sensation associated with imagined movements is internally simulated during motor imagery by recruiting multiple motor areas. Ramachandran, et al., (2003) Visual feedback via a mirror may be beneficial for rehabilitation of some patients with movement deficits secondary to certain neurological conditions. Jennifer A. Stevens and Mary Ellen Philips Stoykov, et al., (2004) Used simulation of movements which was intended as a means to provide smooth and controlled movements by the paretic limb. This simulation of movements provided a compelling perceptual experience of bilateral movements beyond the current capabilities of the affected limb. The benefits of this techinique after a 3 week course of the simulation practice are improved function demonstrated by fugl – Meyer scores. Dohle C, et al .,(2004) Used the term “mirror training”. He concluded that mirroring of the hand /arm movements in normal subjects can lead to activation of the hemisphere contralateral to the seen limb. His study also implies that the observed activation of the contralateral hemisphere by movement mirroring might explain the beneficial effect of mirror training.

James H. cauraugh, et al., (2005) States that planning and executing bilateral movements post stroke may facilitate cortical neural plasticity.Matsuo, et al., (2005) In his study suggested that the mirror therapy can immediately improve the neuromuscular function of paralyzed hand of the hemiplegic patients. Nicholas P Holmes, et al., (2005) States that visual information is weighted more strongly under active visuomotor than passive visual exposure and with increasing exposure duration to the mirror reflected hand. Gentili R, et al., (2006) Put forward the idea that mental training facilitates motor learning and allows its partial transfer to nearby work spaces. They also suggested that “motor prediction” a common process during both actual and imagined movements, is a fundamental operation for both sensorimotor and learning. Magdalena Ietswaart, et al., (2006) Assessed the therapeutic benefits of motor imagery training in stroke patients with persistent motor weakness. He found out that imagining hand movements could stimulate the redistribution of brain activity, which accompanied recovery of hand functions resulting in a reduced motor deficit. Tezuka yasuki, et al., (2006) states that mirror therapy is an effective method of treatment of upper limb paralysis in sub-acute stroke patients. Kenji fukumura, et al., (2007) States that watching the movement of one hand in a mirror makes it easier to move the other hand in the same way.

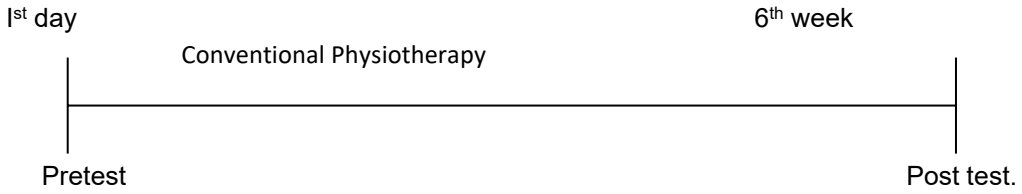
Aim and need for the study:

The aim for the study is to compare the effectiveness of conventional physiotherapy versus conventional physiotherapy combined along with motor imagery and mirror therapy in improving the motor functions in upper extremity in left hemiparetic patients. The results of the study would help the patient and the therapist to incorporate these new techniques to improve the motor functions of the affected upper extremity.

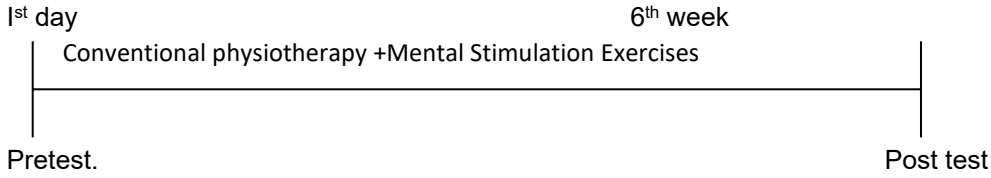
Research design:

This study was experimental in nature. 20 samples were selected by using simple random sampling procedure and were divided into two equal groups, experimental group A – n=10 subjects and experimental group B - n=10 subjects. Pretest scores of fugl Meyer upper extremity motor performance scale for both the groups were taken on the first day. After the pretest assessment, the group A received conventional physiotherapy for period of 6 weeks and group B received mental stimulation exercises along with conventional physiotherapy for a period of 6 weeks. Posttest were taken after the treatment for both the group in a similar fashion as that of the pretest assessment.

Experimental group I:



Experimental group II:



Inclusion criteria:

- Patients with Ischemic stroke (Right middle cerebral artery).
- Both male and female patients were included.
- Patients between 3 to 4 months after the onset of stroke were included.
- Patients with age group between 45 to 55 years were included.
- Patients with Volitional control of non-paretic limb were included.
- A patient who has the ability to follow simple instructions was included.
- A patient who has the ability to follow 2 steps commands was included.
- Patients who show Fugl- Meyer upper extremity motor function scale score =30/60.

Exclusion criteria:

- History of shoulder pain of the affected side.
- Cardio vascular problems and Seizure disorders.
- Mini mental status examination score <23.
- Impaired higher functions.
- Recurrent stroke and Hemorrhagic stroke.
- Cerebellar and brainstem lesions.
- Spinal cord lesion and Arthralgia.
- Contractures of hemiparetic limb.

Population: All subjects who fulfilled the selection criteria were the population of the study. Sample size and method of selection: 20 subjects were selected from the population using simple random sampling procedure (lottery method) and they were further divided into two equal groups randomly. Tools used: a mirror fixed on wooden posts, variables used in the study: independent variable: conventional physiotherapy and motor imagery exercises and mirror therapy. Dependent variable: upper extremity motor performance. Validity and reliability of the tools used: fugl- meyer assessment of physical performance (upper extremity) is a valid and reliable tool for

measuring motor performance of upper extremity. settings: the study was Settings - study was conducted during March 2014 to August 2014 in department of physiotherapy in Alkhums teaching hospital, alkhums, Libya after hospital ethical committee clearance and approval and the patients were selected from Alkhums hospital, Libya.

Methodology:

20 patients with right side MCA ischemic stroke were selected randomly from the population using simple random sampling procedure (lottery method) and were further divided randomly into two equal groups consisting of 10 members in each group (experimental group I & II). After obtaining a verbal consent, the treatment methods were explained to each subject. Both the groups

underwent pretest for motor performance of upper extremity using Fugl–Meyer Assessment of physical performance.In experimental group A the subjects were given conventional physiotherapy in which they were made to use the affected upper limb during the therapy session. In experimental group B the subjects were given conventional physiotherapy in which they were made to use the affected upper limb during the therapy session. Then the subjects were given motor imagery practice for the affected limb in which the subjects practiced imagining executing movements they are going to do which was demonstrated by the therapist. Then the subjects were given mirror therapy exercises in which the subjects used the unaffected hand during the therapy. Subjects undergo exercise training for 6 wks. The post test assessment was done in the similar manner as that of the pre test and all recordings were recorded. Post test measurements were taken on the 45 th day in a similar fashion as that of pre test measurements. A pilot study was conducted a month before the main study with 6 subjects to know the feasibility of the study.

Physiotherapy exercise protocol:

The exercise protocol given to the following groups are: Group A – conventional therapy and Group B - conventional therapy + motor imagery + mirror therapy. MATERIALS AND APPARATUS USED: Mirror fixed to a wooden post so that the mirror can stand alone at the patients mid line for performing exercises by the patient both in sitting and standing.

Conventional therapy:

The patients were made to use his affected hand (Left upper limb). The repetitions of the exercises were done according to the patient's capacity. The exercises are as follows: IN SITTING: Weight bearing on the affected arm: The patients were asked to place his affected hand flat on the bed; the therapist placed one hand under the patient's axilla and the other hand supporting the elbow. The therapist pulled the Indi dual towards her elongating the patient's trunk at the same time. shoulder flexion: The patients were positioned in sitting and asked to flex his affected limb forward to the level as much as he can. Shoulder extension: The patients were positioned in sitting position and asked to abduct his affected limb towards his sides to the level as much as he can. Elbow flexion: The patients were positioned in sitting and asked to flex his affected limb at the elbow as much as he can with the elbow in neutral. Elbow extension: The patients were positioned in sitting and asked to extend his affected limb as much as he can at the elbow with the elbow in neutral.

Wrist flexion: The patients were positioned in sitting and asked to flex his affected limb at the wrist as much as he can with the elbow and shoulder in neutral. Wrist extension: The patients were positioned in sitting and asked to extend his affected limb at the wrist as much as he can with the elbow and shoulder in neutral. Tapping the fingers on the table: The patients were positioned in sitting and asked to tap on the table as much as he can by wrist and fingers by placing the elbow on the table. Reaching the therapists hand in different positions: The patients were positioned in sitting and asked to try reaching the therapist hand in different positions. Place his hands flat against yours and ask him to follow your hand where ever it moves without resistance: The patients were positioned in sitting and asked to place his affected hand flat against the therapists and tried to follow the therapist hand without applying any resistance to the therapist hand. pronation and supination: The patients were positioned in sitting and asked to do pronation and supination of the affected arm as much as he can with his shoulder in neutral. (He is allowed to use his normal limb to complete the movements). The patient pronates and supinates his elbow with the shoulder in neutral. Manipulation of objects of different size and shape: The patients were positioned in sitting and asked to manipulate object of different size and shapes placed on the table.IN STANDING: The patient is made to use his affected upper limb (left hand) Patient position: Standing Therapist position: standing behind the patient The exercises are as follows: Weight bearing on both hands: The patients were positioned in standing and asked to place both his upper limb flat on a table in front of him. The therapist assisted him to extend his elbow thus helping him to maintain elbow in extension and wrist in flexion. Wrist pronation: The patients were positioned in standing and asked to pronate his wrist as much as he can with shoulder in neutral and elbow flexed. Wrist supination: The patients were positioned in standing and asked to supinate his wrist as much as he can with his shoulder in neutral and elbow in flexed position. Reaching tasks in standing with the affected hand: The patients were positioned

in standing and asked to try reaching to different direction and heights with his affected hand.

In experimental group B along with conventional therapy the subjects were given motor imagery practice in which the subjects practiced imagining the movement they are going to do which was demonstrated by the therapist. Then the subjects were given mirror therapy exercises in which the subjects used the unaffected hand during the therapy:

Conventional therapy + motor imagery exercises + mirror therapy

exercises Conventional physiotherapy:

Conventional therapy exercises were performed in the same rate as mentioned above after which the subjects were given with motor imagery exercises.

Motor imagery exercises:

The subjects practiced imagining execution of movements on the affected side as demonstrated by the therapist. The protocol is carried out in such a manner in which for the first 20 minutes, the researcher (as a model) performed the specific exercises of upper extremity at various speeds, on either side of the mirror, for mental stimulation. After the motor imagery, warm up tasks, the patient is asked to perform the same during the treatment sessions. The structure of the mirror reflection tasks presented to the patient can be tailored to the individual needs. During the first week the patient focused on learning to identify the hand reflected in the mirror as his own paretic limb moving around for him. In the subsequent weeks, relatively simple tasks will be completed.

Mirror reflection exercises in sitting:

Therapist position: standing behind the patient. Affected limb is kept at rest behind the mirror. Unaffected limb is made to move in space creating bilateral movements including smooth movements completed by the simulation of the affected limb. MOVEMENTS IN SITTING INCLUDE: Shoulder flexion: The patients were positioned in sitting in front of the mirror and asked to flex his right shoulder as much as he can with elbow extended and wrist in neutral. Elbow flexion: The patients were positioned in sitting in front of the mirror and asked to flex his right shoulder as much as he can with shoulder and wrist in neutral. Elbow extension: The patients were positioned in sitting in front of the mirror and asked to extend his right elbow as much as he can from flexed position with shoulder and wrist in neutral. Forearm supination: The patients were positioned in sitting in front of the mirror and asked to supinate his right forearm with his right shoulder and wrist and shoulder in neutral. Forearm pronation: The patients were positioned in sitting in front of the mirror and asked to pronate his right forearm as much as he can with his right shoulder and wrist and shoulder in neutral Wrist flexion: The patients were positioned in sitting in front of the mirror and asked to flex his right wrist with his right shoulder at few degree of flexion and elbow at around 80 to 90 degree of flexion. Wrist extension: The patients were positioned in sitting in front of the mirror and asked to flex his right wrist with his right shoulder at few degree of flexion and elbow at around 80 degrees to 90 degrees of flexion. Tapping the fingers on the table: The patients were positioned in sitting in front of the mirror and asked to tap on the table by his right wrist and fingers by placing his right elbow on the table. Simple manipulation tasks with objects of various sizes and weights. The patients were positioned in sitting in front of the mirror and asked to try manipulating object of different size and shapes with his right hand placed on the table.

Movements In Standing Include: Therapist position: standing behind the patient. Shoulder flexion: The patients were positioned in standing in front of the mirror and asked to flex his right shoulder as much as he can with his right elbow extended and wrist in neutral. Elbow flexion: The patients were positioned in standing in front of the mirror and asked to flex his right shoulder as much as he can with his right shoulder and wrist in neutral. Elbow extension: The patients were positioned in standing in front of the mirror and asked to extend his right elbow as much as he can with his right shoulder and wrist in neutral. Forearm supination: The patients were positioned in standing in front of the mirror and asked to supinate his right forearm with his right shoulder as much as he can with his right wrist and shoulder in neutral. Forearm pronation: The patients were positioned in standing in front of the mirror and asked to pronate his right forearm as much as he can with the shoulder and wrist and shoulder in neutral. Wrist flexion: The patients were positioned in standing in front of the mirror and

asked to flex his right wrist as much as he can with his right shoulder at few degree of flexion and elbow at around 80 degrees to 90 degrees of flexion. Wrist extension: The patients were positioned in standing in front of the mirror and asked to flex his right wrist as much as he can with the shoulder at few degree of flexion and elbow at around 80 degrees to 90 degrees of flexion. Moving the affected arm as best they could in free space the patients were positioned in standing in front of the mirror and asked to move his right limb as much as he could in free space in front of the mirror.

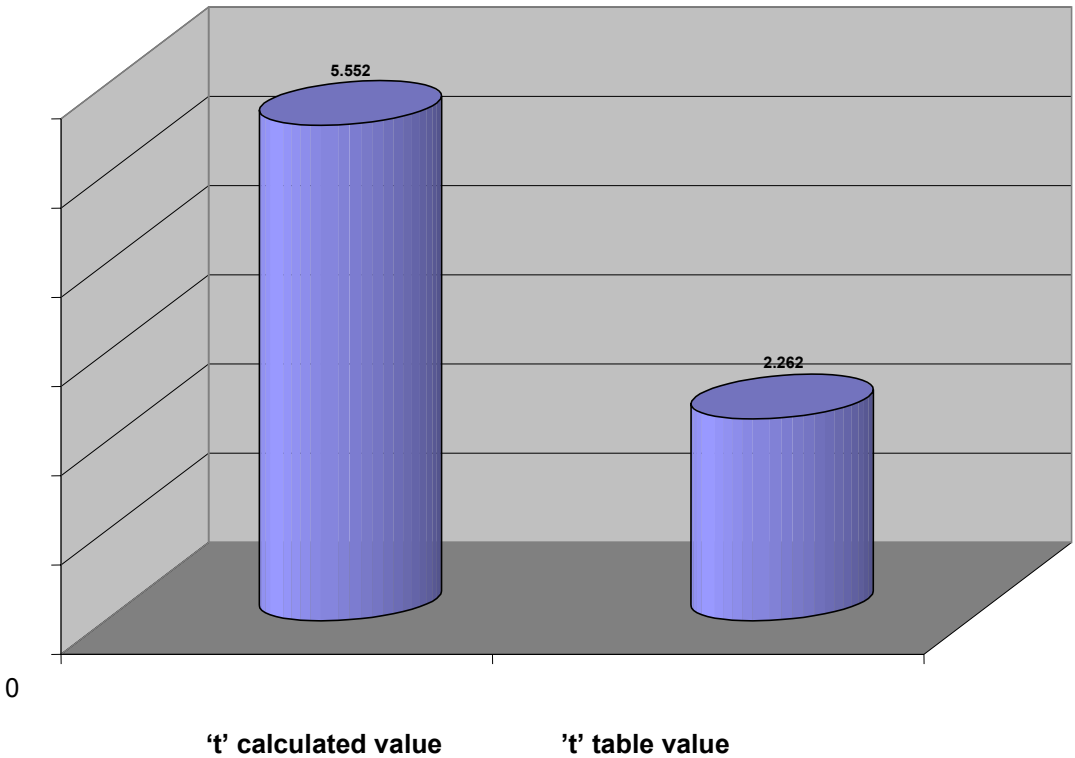
Observation and analysis:

TABLE (1): PAIRED 'T' TEST

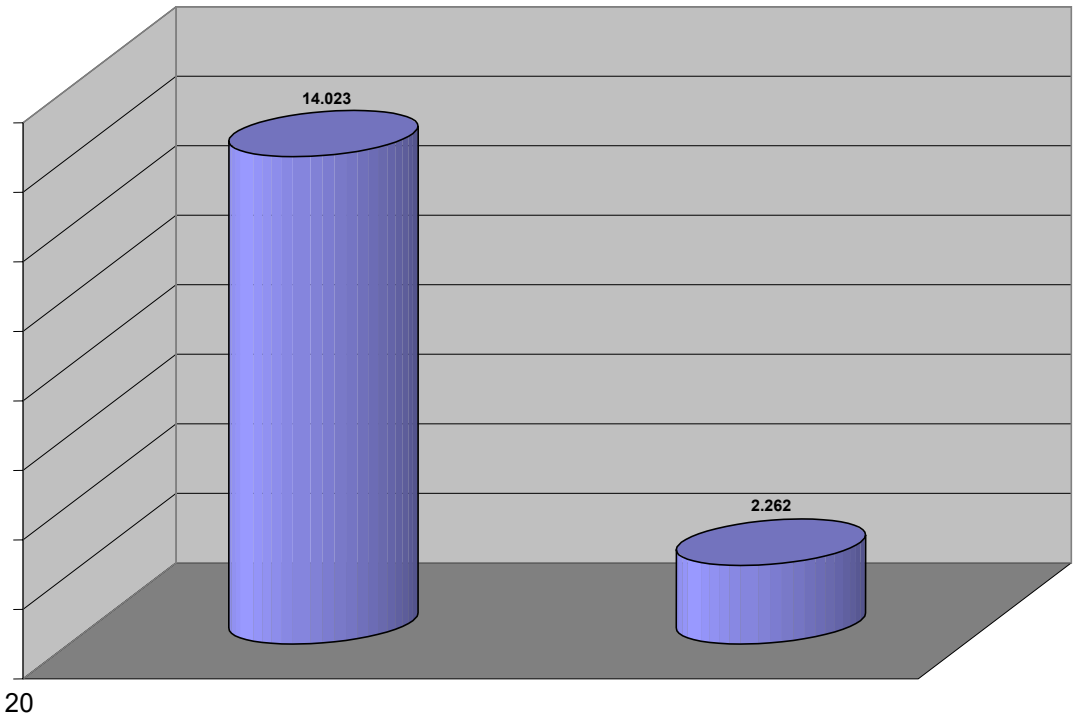
Variable	't' calculated value	't' table value
Upper extremity motor performance (FUGL MEYER) group I	5.552	2.262
Upper extremity motor performance (FUGL MEYER) group II	14.023	2.262

The collected data were subjected to paired t test individually for the group I and group II. The 't' calculated value of the paired t test for motor performance of upper extremity of upper extremity for group I who underwent conventional therapy alone and group II who underwent conventional therapy along with motor imagery and mirror therapy were **5.552** and **14.023** respectively. The't' table value for 9 degrees of freedom at 5 % level of significance was found to be **2.262** respectively. The't' calculated values of paired't' test were matched with't' table values. It was found that't' calculated is > table value for both the groups. After the paired't' test the data were subjected to independent 't' test to analyze any difference in improvement between group I and group II.

Comparison of 't' cal and 't' tab Value Of Paired 't' Test for Group I:



Comparison of 't' cal and 't' tab Value of Paired 't' Test for Group II:



Comparison of 't' cal and 't' tab value of independent 't' test:

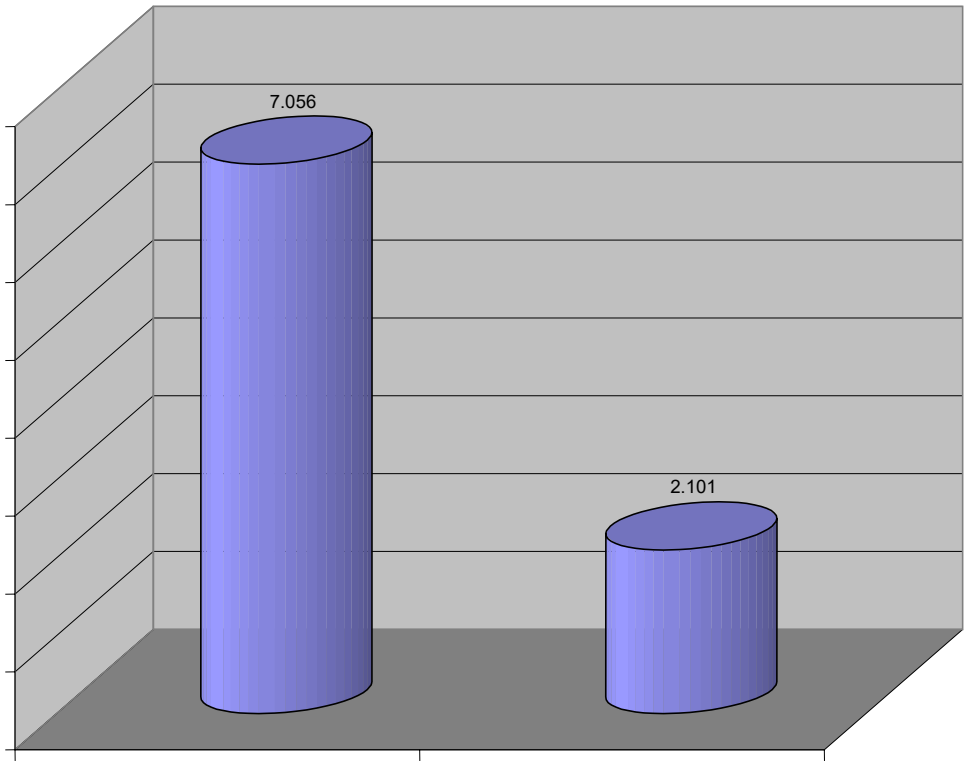


TABLE (2): INDEPENDENT 'T' TEST

Variable	't' calculated value	't' table value
Upper extremity motor performance (FUGL MEYER)	7.056	2.101

The‘t’ calculated value of independent‘t’ test Upper extremity motor performance was found to be **7.056** respectively. The‘t’ table value for 18 degree of freedom at 5 % level of significance was found to be **2.101** respectively. The‘t’ calculated value value of independent‘t’ test was matched with‘t’ table value. It was found that’t’ calculated value >’t’ table value. The outcome of statistical analysis shows the significant effects of both the treatment protocols in experimental group I and group II and the significant difference between the improvements in favor of experimental group II.

Results:

The datas were subjected to statistical analysis and the following results were obtained. There is a statistically significant improvement in motor performance of upper extremity treated with conventional physiotherapy. There is a statistically significant improvement in motor performance of upper extremity treated with conventional therapy along with motor imagery and mirror therapy exercises. There is a statistically significant difference in improvement produced by conventional therapy along with motor imagery and mirror therapy exercises than conventional physiotherapy alone in improvement of motor performance of upper extremity in left hemiparetic stroke patients.

Discussion:

The improvement in motor performance of upper extremity of the group I who received conventional physiotherapy alone might be due to the reduction of spasticity through attention to trunk posture and controlled muscle stretch which might have caused reduction in segmental reflex hyper excitability through inhibition of distal segmental reflexes Via Ib inhibitory inter neurons. (Bipin B Bhakta, (2000); Management of Spasticity, British medical Bulletin. Vol 56 (Issue number 2) Page number 476 to 485.) The improvement in the group II receiving conventional physiotherapy along with motor imagery and mirror therapy can be due to the following reasons. In mirror therapy the simulation provides a compelling perceptual experience of bilateral motion beyond the current capabilities of the affected limb. This might have Facilitated employment of the motor copy strategy (bimanual movements) and later progression to “forced use” of the affected Arm. (K. Sathian, MD, Phd, September (2000); Doing it with mirrors: A Case Study of a Novel Approach to Neurorehabilitation, Neurorehabilitation and neural repair, Volume 14, (issue no 1) Pages 73 to 76.) Imagining the hand movements could have stimulated the redistribution of the brain activity which accompanies recovery of the hand functions leading to decreased motor deficit. (Stephen J page, August (2001); Mental Practice Combined with Physical for Upper – Limb Motor Deficits in Sub Acute Stroke, Physical Therapy, volume 81, (Issue 8) pages 1455- 1462.) The effects of motor imagery and mirror therapy on motor skill learning are the results of practice on central motor programming. According to this study it seems logical that mental stimulation exercises might have modified the neuronal activity in the primary sensorimotor areas and have consequently improved the performance of the upper extremity. The Combined physiological effects of the conventional therapy and mental stimulation exercise might be the reason behind the significant improvement seen in group II, then group I who received only conventional therapy.

Recommendations for further study:

Based on the outcome of the statistical analysis, it is suggested that the future studies should be modified to accommodate the following changes: Left hemiparesis due to other disorders can be done in future studies. This study can be done for right hemiparetic patients also. Other form of upper extremity scales can be used for assessment and evaluation.

Conclusion:

The result of the study make us conclude that conventional therapy combined with mental imagery and mirror therapy is better than conventional therapy alone in improving upper extremity motor functions in left hemiparetic patients.

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