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Efficency of Motor Imagery with Conventional Therapy in Gait Training of Stroke Patient

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ABSTRACT

Total 30 participants including both male and female who were previously diagnosed by neurologist as having was recruited for the study. Subjects will be selected as per convenient sampling and assigned into two groups *i.e.* group-A (Experimental group) and Group–B (Control Group). In Group-A subjects were given motor imagery and conventional therapy both; in group-B subjects were given conventional therapy alone. Group A got 13 subjects with (mean age = 65.46±7.55) and Group-B got 13 subjects with (mean age = 65.69±5.58). Both programs were concluded in the respective participants home and hospital environment. None of the subjects attended physiotherapy for lower limb anywere else during the study. Baseline measurements was taken at the start of treatment program, using gait variables as outcome measures *i.e.* stride length, step length, Gait velocity & Cadence. Results of post reading in both groups (for stride length (p=0,928) and post stride (p=0.592), for pre step length (p=0.777) and post step length 9p=0.631), for pre gait velocity (p=0.4590 and post gait velocity (p=0.959), for pre cadence (p=0.986) and post cadence (p=0.844) show significance improvement, but improvement in Group-A was more than in Group-B. As per the results of the present study, Motor imagery program is found to be effective when given with conventional therapy in improving gait in stroke subjects. Moveover it can be done easily by the patient as it takes effort and motivates the subject for performing the desired task. It also does not fatigue the patient. Thus, it is a feasible method and can be applied in conjunction with conventional therapy while treating stroke patients with gait issue.

Keywords: Motor imagery; Gait velocity; Cadence; Stroke.

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INTRODUCTION

Stroke is an acute onset of neurological dysfunction due to abnormality in cerebral circulation with resultant sign and symptoms that correspond the focal area of brain. This can be due to ischemic caused by thrombosis caused by thrombosis or embolism or due to a hemorrhage.[1] Stroke can result in many different disabilities, ranging from motor control and urinary incontinence to depression and memory loss. Stroke usually occurs on only one side of the brain, so decreased motor control (the ability to move muscles in a co-ordinated manner) usually develops on only in eside of the body. In fact, one side of the body may be paralyzed (hemiplegia), or muscles on the affected side may be weakened (hemiperesis). Because of the weakness of paralysis in large muscle groups, injuries from fall are common complications of motor control disturbances.[2] There is alternation in tone after stroke. Flaccidity (hypotonicity) is present just after stroke and is due primarily to the cerebral shock. It is generally short lived, lasting a few days and weeks. Spasticity (hyper tonicity) emerges in about 90% of the cases and occurs on the side of the body opposite the lesion. Spasticity in upper motor syndrome occurs predominately in the antigravity muscles. In the lower extremity spasticity is often strong in the pelvic retractors, hip adductors and internal rotators, hip and knee extensors, plante rflexors and supinators and toe flexors. Spasticity results in tight (stiff) muscles that restrict volitional movement. Posturing of the limb (eg, a tight fisted hand with the elbow bent and held tightly against the chest or a stiff extended knee with a plantar flexed foot) is common with moderate to severe spasticity. Reflexes are altered and also vary according to stage of recovery. There is initially hypo reflexia with flaccidity, then hyper reflexia with spasticity.[3] Gait is altered following stroke pwing to a number of factors. Common problem associated with hemiplegia gait according to phase are: in stance phase; weak hip extensors, flexors contracture at trunk/pelvis, trndelenburg limp (weak abductors), scissoring (spastic adductors) at hip, flexion contractures, werak hip and knee extensors poor proprioception, ankle dorsiflexion range past neutral at knee, equinus gait (spasticity or contracture of gastrocnemius soleus), varus foot 9 hyper active or spastic tibialis anterior, post tibialis, toe flexors and soleus), unequal strep length at ankle/foot. In swing phase; week abdominal muscles weakness of flexors muscles at trunk/pelvis, weak hip flexors, poor proprioception, spastic quadriceps, abdominal weakness (hip hikers) at hip, in adequate knee flexors (spastic quadriceps), weak knee extensors (spastic hamstrings) at knee, plantar flexors contracture or spasticity, weak dorsiflexors, delayed contraction of dorsiflexion, toe frag during midswing at ankle/foot.[3] Walking after stroke is often impaired and restricted to short distances. The average walking speed of people with hemiparesis is lower then that of people without known pathology or impairement, with values ranging from 0.23 to 0.73 m/s, depending on severity of the hemiparesis. Characteristically for these individuals, stride length and cadence are lower than normal and a greater proportion of the gait cycle is occupied by double support and same phase duration of both lower extremities (particularly of the unaffected lower extremity), as compared with people without hemiparesis.[4] Mental imagery is using our "minds eye" to picture situation without actually being there. When we look forward to a particular events we use imagery. Sometimes we visualize the expected outcome of an upcoming event, and this affects our motivation. Picturing pleasant consequences can lead to excitement, even an emotional high, but imagining negative outcome can evoke fear. An individual can imagine themselves performing desired behaviors, the greater the beneficial impact of this technique on actual performance. Motor imaginary is a dynamic state during which an action is mentally stimulated without any body movement.[10] It is the active process of reliving sensation with or without exyernal stimului.[13] This is facilitated by the use of images brought about by combination of different modalities, *i.e* visual, auditory, tactile, kinesthetic, gustatory. When movement of an action of aperson or objects is imaged, this is called movement imagery. Specifically when it is human body that is imaged by the internal reactivation of action within working memory without overt motor out put it is called motor imagery.[5] This shows that the rehearsal of a physical activity in absence of an gross muscular movement through motor imagery improve motor performance.[5] Thus patients can continue motor imagery training even when they are already physically exhausted or when supervised therapy sessions have finished.[5] Motor imagery has its origin in the sports psychology and behavior psycology.[6] The "Psycho neuromuscular theory" by Jacobson in early 1930s shows that there is myoelectrical changes related to imagined movement.[6] A large number of functional neuro-imaging studies have demonstrated that motor imagery is associated with the specific activation of the neuronal circuit (The supplementary motor area, the primary motor cortex, the inferior parietal cortex, the basal ganglia, and the cerebellum) involved in the early stage of motor control (*i.e* motor programming). Such physiological data gives support about common neural mechanisms of imagery and motor preparation. Motor imagery activates motor pathway. Functional brain imaging studies have indicated that several cortical and subcortical areas activation during actual motor performance are also active during imagination or mental rehearsal of movement.[9] In the absence of the movement, there is detectable EMG activity during motor imagery, this shows there is an cortical excitability with no changes in spinal excitability.[7] Motor imagery is a high level process which however manifests itself in the activation of those same cortical circuit that are normal involved in the movement execution.[8] Reports have described the contribution of motor imagery practice for improving upper extremity functions in patients with hemiperesis following stroke.[9] Previous case reports also suggests motor imagery is useful for the enhancement of walking ability in patients following stroke. And also imagery training can be considered as a useful option for restoration of ambulation for individuals with chronic hemiparetic stroke who are unable to participate in physical gait training.[11] Imagery practice should focus on its specific impairement during gait in order to affect the performance of the paretic lower extremity with conventional therapy.[4-10]

METHODOLOGY

Sample: Total 30 participants including both male and female who were previously diagnosed by neurologist as having was recruited for the study.

Subjects were taken from different hospitals of Delhi, Haryana and Dehradun.

Study Design: Experimental study.

Method of Selecting and Assigning Subjects

Subjects will be selected as per convenient sampling and assigned into two groups i.e. Group-A (Experimental group) and Group–B (Control Group). In group-A subjects were given motor imagery and conventional therapy both; in Group-B subjects were given conventional therapy alone.

Inclusion Criteria

- Ambulatory stroke patient can ambulate 16 m (with or without assistive device).
- Stroke of at least 3 month duration.
- No serious unstable medical condition.
- Not receiving any other form of physiotherapy for lower limb.
- Mini mental state examination (>23).
- Movement Imagery Questionnaire – Revised second (MIQ-RS0): (score of 98 is good, score of 14 is worse).

Exclusive Criteria

- Spinal deformity
- History of spinal trauma or head injury
- Any other neurological disease
- Unhealed fractures
- Peripheral arterial occlusive disease
- Orthopaedic disorders involving any joint of lower limbs
- History of neurological disease other than the chronic stroke

Instrumentation

- Plinth or couch (Performing motor imagery)
- Stopwatch (For evaluation of gait velocity)
- Plain surface for walk test (at least 16 m)
- Chart paper (6+6 m per subject)
- White board marker (for heel strike mark)
- Adhesive tape & double tape (For attachment of marker with shoe)
- Inch/Measurinng tape (measurement of space and chart)
- Scale (measurement of step length and stride length)

Outcome Measure

- ***Stride length Measurement:*** (the average of middle stride) cm
- Step length measurement (the average of the middle three steps) cm
- ***Gait Velocity Measurement:*** (6m x 60 sec ÷ time for walk in sec) m/min.
- ***Cadence Measurement:*** (# marks x 60 ÷ time for walk in sec) step/min.

Fig. 1: Stop watch

Fig. 2: Measuring tape, measuring scale, white board marker and adhesive tape

PROTOCOL

This study consisted of two groups: Experimental group (A) and Control group (B) subjects were chosen as per the inclusion and exclusion criteria, and informed consent was obtained from all subjects after the procedure was explained to them.

The 4 weeks intervention was given to the subjects of both groups alternately, 3 days a week for Group A and 3 days a week for Group B. 45-50 minutes protocol for Group A and 30-40 minutes protocol for Group B.

Group A *Protocol*[1,4,12]

This group received Motor imagery (10-15 minutes) & Conventional therapy (30-40 minutes) both and it was given in single session of 40-50 minutes. The program was conducted for 3 times per week. Total duration of both programs was for 4 weeks.

Motor Imagery Techniques used

The internal as well as external imagery scenes were applied in this intervention protocol.

The 2 main goals were

1. To facilitate movement and posture of the affected lower extremity during gait by focusing on specific impairements.
2. To enhance functional walking within subjects own environment.

Conventional therapy Technique used

The conventional therapy for gait training in the group was given as per the protocol of Group B.

Group-B Protocol

In this group Intervention of conventional therapy alone was given for 30-40 minute. In conventional gait training, patients practiced functional (1) Task specific locomotor skill walking forward and side stepping (5 minutes)[1,16] (2) Elevation activities (e.g. step-up/step-down, lateral step-up, stair climbing) (3) Community activities (walking on ramps, curves and over and around obstracles), and (4) Quadriceps strengthening.[15]

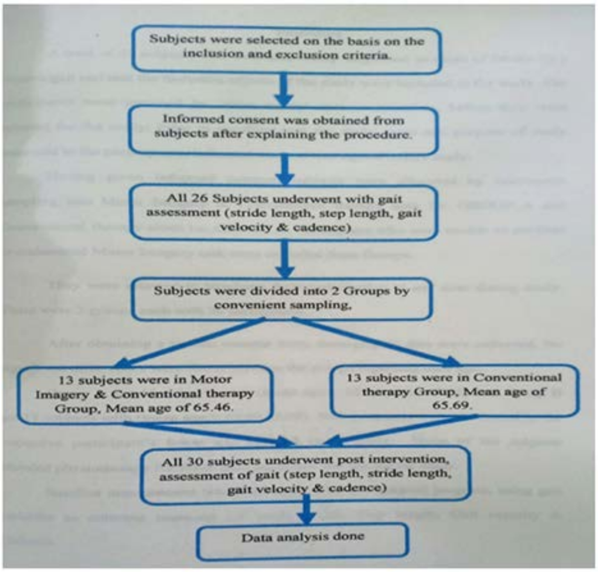

Fig. 3: Flow chart according to Protocol.

Procedure

A total of 26 subjects who were previously diagnosed as cases of strokes by a neurologist and met the inclusive criteria of the study were included in the study. The participants were screened by mini mental state examination, before they were selected for the study, Prior to enrolling into the study, need and purpose of study were told the participants. Informed consent was signed before study.

Having given informed consent, subjects were allocated by convenient sampling into Motor Imagery & Conventional therapy both *i.e.* Group-A and Conventional therapy alone *i.e.* Group-B Participants who were unable to perform or understand Motor Imagery task were excluded from Groups.

They were allowed to terminate their participants at any time during study. They were 2 groups with 26 participants.

After obtaining a written consent from, demographic data were collected. No significance differences were found between the groups regarding their age.

Group-A got 13 subjects with (mean age = 65.46 ± 7.55) and Group-B got 13 subjects with (mean age =65.69 ± 5.58). Both programs were concluded in the respective participants home and hospital environment. None of the subjects attended physiotherapy for lower lmbanywerealse during the study.

Baseline measurements was taken at the start of treatment program, using gait variables as outcome measures i.e. stride length, step length, Gait velocity & Cadence.

GAIT ASSESSMENT

The procedure requires only a stop watch, two felt tip marking pens with was hable ink, and a 16 m (53 feet) walkway, That is premeasured and marked with masking tape at four points. A halfway, an outside cement area at a clinic, or patients home as well as a portion of a clinic floor can be used for the walkway. The walkway is marked to show a center area 6m long and two 5 m areas on each end. Measurement are made within the 6 m area only; the two 5 m areas allow for warming up to "normal" velocity before measurement and slowing down after measurement. Using these extension of the measurement area of the walkway is intended to eliminate measurement errors.

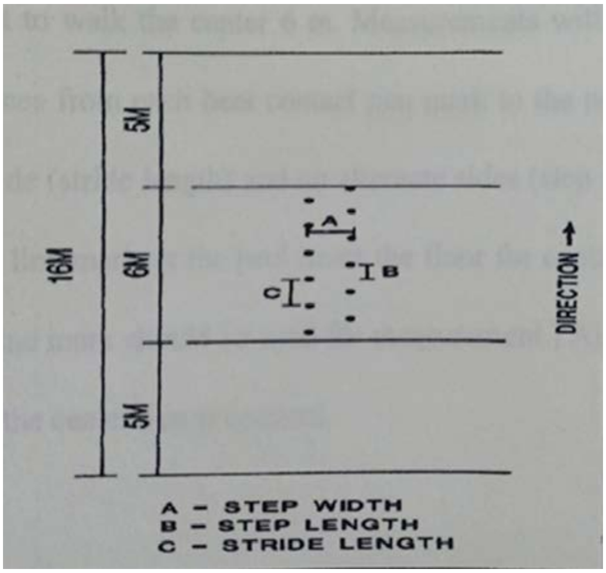

Fig. 4: Shows pattern of steps.

Felt tip marking pens are taped to the back of patients shoes so that the tip just reaches the floor when he is standing. Before the procedure, the patient should take a few steps at the side of walkway to ensure that the markers are correctly positioned to indicate heel contact.

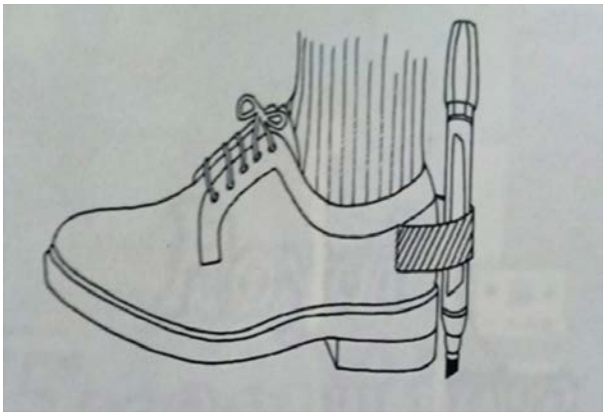

Fig. 5: Shows attachment of marker to the shoe with adhesive tape.

The patient is instructed to walk at his usual walking speed from one end of the 16 m walkway to the other end. The therapist, using a stopwatch, record the time taken for the patient to walk the center 6 m. Measurements within the 6 m area are then made of distance from each heel contact pen mark to the next heel contact pen mark on the same side (stride length) and on alternate sides (step length). (Sometimes the marker leaves a line mark as the heel nears the floor for contact. The point at the termination of the line mark should be used for measurement). Also, the total number of contacts marks in the center 6 m is counted.

Motor Imagery Technique:

For training gait by motor imagery therapist/ myself was in front of subjects who was sitting on the chair with arm rest or lying on the bed as per the comfort of subjects. Initially subjects were introduced with Motor Imagery technique. They were well explaned about it.

Then imagery gait was practiced in the living room, emphasizing imagery experience, using all sensory modalities. For example give instruction to subjects to imagine the scene of the pictures on the wall as if you are watching it in reality. Timing, sequencing, and spacing of the Mental Imagery practice activities were based on established principals taken from the motor learning discipline and on report of the application of these principles to stroke rehabilitation. If subjects was not able to do or was doing in wrong way, therapist/myself guided how to imagine things/activity with relaxed and calm manner. Then the, subjects were told for another task for example try to use your imagery ability to hear the sound of your footsteps on the floor. Individuals engaged in such imagery tasks are consciously aware of it and able to report the content of the imagined acts or scenes.

Specific impairments chosen as targets for intervention were (1) Fore foot initial contact (2) Deficient push-off during stance, (3) Reduced knee flexion during swing. Concomitantly, imagery practice was directed towards improving (1) Gait speed and symmetry, (2) Towards negotiating walking routes indoors and outdoors (e.g. public buldings, uneven terrains). Additionally, the gait was practiced under variable circumstances with only intermittent or minimum oral feedback presented during practice.

Each Practice Session was Composed of: (1) the provision of explicit information on task characteristics and environmental circumstances (1-2 minutes), (2) imaging of walking activity from an external perpective (3-8 minutes), (3) imaging of walking activity from an internal perspective (3-8 minutes),[14] and (4) refocusing of attention on the immediate surroundings and on genuine body position (1 minute).

Time Schedule and Major tasks that were Practiced are:

First week: Familiarization with motor imagery practice. Practice imagery gait in the living room, emphasizing imagery experience, using all sensory modalities.

Example: "Try to imagine the scene of the pictures on the wall as if you are watching it in reality. "Try to use your imagery ability to hear the sound of your foot steps on the floor."

Second Week; Practice of missing components (impairement) in gait performance of the paralytic lower extremity, focusing on the knee flexion during swing, on heel contact during stances, and on the timed application of propulsive force during push-off.

Examples; "Try to see your left knee flex as high as your knee." "Try to feel your left knee flex as high as your right knee." "During each step, price to lifting your leg, try to feel that your foot is strongly pushing backward towards your floor."

Third Week: Practice continued as in second week, with additional emphasis on loading of the affected side during stance and on increasing gait speed.

Example: 'In each step, feel that you some what extended the time you stand on your unaffected leg future ahead." "Imagine that you are walking faster than your current tempo." "Feel that you move each of your feet father ahead.

Fourth Week: Further gait practice focused on integrating the prior practice component into the strep cycle and on increasing symmetry and gait velocity.

Examples: "Try to 'see' both of your legs making the same movement." "Feel each foot going up the same height as the other." "In each step, feel forefoot is strongly pushing against the floor prior to 'take off.'

Reinforcement was applied through imagery of feeling of confidence in gait performance and of successful accomplishment of the practiced tasks. That is, the trainer encouragement feeling of safety, calmness and satisfaction as well as after completion of the imagery gait.

Conventional Therapy for Gait

Task-Specific Locomotor skill walking:

Subjects standing with hip in correct alignment, subjects practices stepping forward then backward with intact leg, making sure he/she extends his/ her affected hip as he/she steps forward. I stand on either in front or on affected side and encourage the subjects to take weight through affected leg. Like wise instruct to subjects for forward walking. Subjects was instructed for side walking by hip abduction and takes long step at one side and follow by the other step.

Elevation Activities:

Subjects was instructed to take a step-up on stairs by flexing hip and knee, with giving load on the forward limb and elevate his/her body to climb the one stair up. Then subjects was instructed for step-down the stair by hip extension of one limb and hip flexion and knee flexion of others. Assistance was required where subjects is not able to perform the activity due to fear of falling. Likewise subjects was instructed stair climbing.

Community Activities:

Subjects perform walking on ramps, curves and uneven terrains as this increase the gait speed by increasing endurance. The over and around obstacles task was also given to the subjects by placing a stick in front of subjects and instructed for walk over the stick.

Quadriceps Strengthening:

Resistive strength training was given to subjects by trying weight cuff to the foot, and performance extension of knee.

RESULT

26 Subjects with stroke who met the inclusion criteria participated and completed the study. No significance differences were found in the base line values of age and height among groups.

The mean and standard deviation of age, height and weight was calculated for the 30 subjects as follows age - 65.45 ±7.55, height - 169.233 ± 6.55.

Students T-test was done to compare the data of pre stride length between the groups (p=0.928).

Paired t-test was done to compare the data of the stride length with in the groups for stried length both the groups showed significant difference [Group-A (P=0.0023) and Group-B (P=0.000)].

Students T-test was done to compare the data of post stride length between the groups (p=0.592).

Students T-test was done to compare the data of pre step length between the groups (p=0.777).

Paired t-test was done to compare the data of step length within the groups. For step length both the groups showed significant difference [Group A (p=0.024) and Group B (p=0.002)].

Students T-test was done to compare the data of post length between the groups (p=0.0631).

Students T-test was done to compare the data of pre Gait velocity between the groups (p=0.459).

Paired t-test was done to compare the data of velocity within the groups. For Gait velocity both the groups showed significance difference [Group A (p=0.015) and Group B (p=0.000)].

Students T-test was done to compare the data of post Gait velocity between the groups (p= 0.959).

Students T-test was done to compare the data of pre cadence between the groups (p=0.986).

Paired T-test was done to compare the data of Cadence within the groups. For Cadence both the groups showed significance difference [Group-A (P=0.024) and Group-B(p= 0.002)].

Students T-test was done to compare the data of the post cadence between the groups (p= 0.844).

- From the above results we can say that both treatment were effective for both groups.
- From the above results, we can say that Group A showed significant improvement as compared to Group B in step length, stride length, Gait velocity and cadence.
- Gait assessment of Group A showed significant improvement at post intervention compared to Group B.
- From these results we can conclude that the Groups A is better that Group B.

Table 1: Shows Mean d and SD of Pre-Step length & Post-Step length (STL) for Group-A and Group-B

Group-A				Group-B			
STL				STL			
Pre		Post		Pre		Post	
Mean	SD	Mean	SD	Mean	SD	Mean	SD
31.42 t=2.59 P=0.024	7.7	38.17	12.09	31.13 t=3.825 P=0.002	7.17	36.07	9.2

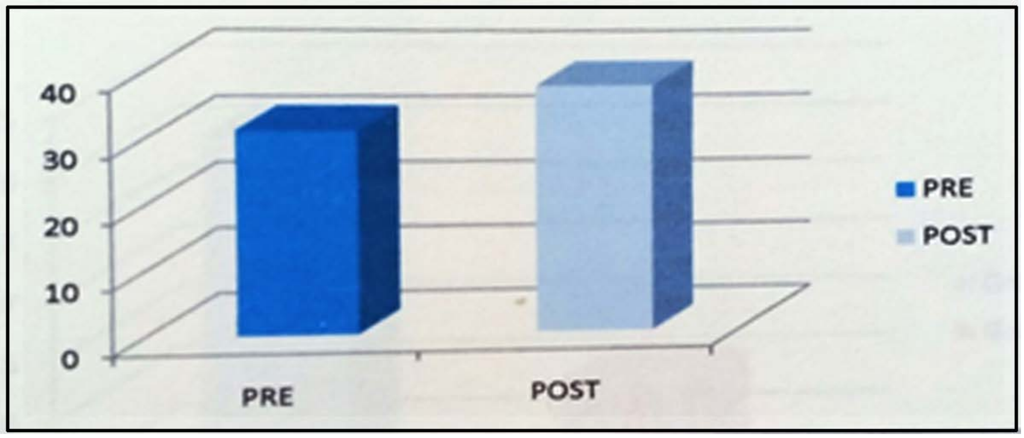

Fig. 6: Shows improvement in Post-Step length than Pre-Step length in Group-A

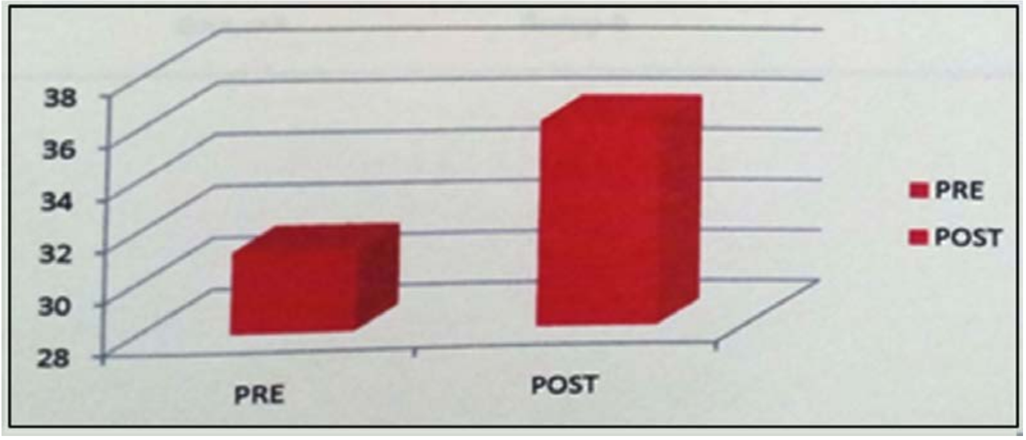

Fig. 7: Shows improvement in Post-Step length than Pre-Step length in Group-B

DISCUSSION

Our study aimed to improve walking. Walking is basic mobility and enhances independence to any one. The ability to walk independently is a life enriching activity and the most efficiently way of getting from one place to another in the course of our daily lives.

The temporospatial gait characteristics indicate that cadence is especially adversely affected by stroke and that the improvement in gait speed is mainly due to an increase in stride length and, to a lesser extent, to an increase cadence. There significance improvement in post interventional reading of (for stride length p=0.023, for step length p=0.024, for gait velocity p=0.015 and for cadence p=0.024) Group-A, because as per previous studies conventional therap with motor imagery with conventional therapy is effective in the time difference to perform the task from pre tp post–intervention.[24] S.A. Zimmermann *et.al* says that evidence suggests Motor imagery provides additional benefits to conventional physiotherapy or occupational therapy.[10] Some author says that locomotor imagery training can be considered as a useful option for restortation of ambulation for individuals with chronic hemiperesis stroke who are unable to participate in physical gait training.[11] Ehrsson *et.al* showed an activation of specific limb area in the primary motor cortex.[13] Motor Imagery is a dynamic state during which the representation of a specific motor action is internally activated without any motor output. In other words motor imagery requires the conscious activation of brain region that are also involved in movement prepration and execution, accompanied by a voluntary inhibition of the actual movement. Some autor reported that the activation of the pre-supplementary motor area and the primary motor cortex during imagery of locomotion movements. Researchers hypothesized that movement execution; motor imagery and action observation S are all driven by the same basic mechanism. Motor imagery and action observation are conceived as ″offline‶ operation of the motor areas in the brain. Researchers also reported that better equilibrium characteristics in elderly women as measured by walking balance and foot placement measures as a result of a combined treatment of motor imagery and physical therapy.[17] As Motor Imagery intervention did not sufficiently modify the asummetry that is an inherent featuers of hemiperisis so it should be given with conventional therapy.[4] Some researchers says that Imagery, in association with therapy, appears to be a non invasive, efficacious complement to traditional therapy that substantially reduces impairement and improves outcomes.[13] On other side there is significant improvement in post–reading of (for stride length p=0.000, for step length p=0.002, for gait velocity p=0.000 and for cadence p=0.002) Group-B also because as per the previous research results, conventional therapy for stroke is effective for getting ambulation and improvement in gait. Researchers say that Task specific activites with strength training are effective therapeutic intervention for post stroke. Possible mechanisms accociated with response to therapy were related to improve motor unit activation associated with increased strength in key muscles used in gait.[18] Author present an intriguing hypothesis that overgroung gait training such as walking while forward, sideways, may be better suited in educating patients regarding safety, while encouraging participation in therapeutic exercises to improve strength cardiovascular fitness, movement efficiency and agility,″ Overground gait training improves locomotor function and is a major goal of rehabilitation, and if patient want to improve walking they need to practice walking. Overground gait training represents the most task specific approach in improving gait for individuals with hemopresis after stroke.[19] It was also hypothesized that strengthening and physical conditioning are to reduce impairement and disability in chronic stroke surviors.[20] Stroke rehabilitation provides a targeted and organized plan to relearn functional lost in the shortest period of time possible. Some studies suggests that successful and meaningful recovery is most likely to be accomplished if you are dedicated and keep a high level of motivation during your rehabilitation process.[21] It is recognized that participation by patients in active physical therapeutic programs probably provides direct influence on the process of functional reorganization in the brain and enhances neurological recovery. A key aspect of neutral plasticity that has important implication for rehabilitation is the fact that the modification in neuronal networks are use dependent. Clinical trail have shown that forced use and functional training contributes to improve function.[22] Standardized community based rehabilitation therapy also help stroke patients to improve their neurological function.[23] Clinical studies demonstrated that training or inpatient rehabilitation increases cortical representation with subsequent functional recovery, whereas a lack of rehabilitation or training decreases cortical representation and delayed recovery.[23] Results of post reading in both groups (for stride length (p=0,928) and post stride (p=0.592), for pre step length (p=0.777) and post step length 9p=0.631), for pre gait velocity (p=0.4590 and post gait velocity (p=0.959), for pre cadence (p=0.986) and post cadence (p=0.844) show significance improvement, but improvement in Group-A was more than in Group-B. In past two studies it was seen that Motor imagery provided additional benefits to conventional physiotherapy when given for upper limb functioning.[10] This can for the post Intervention results of the present study where the mean value of experimental group showed better results than the mean value of control group. Researchers determined that embedded MI (Motor Imagery with conventional therapy) is superior to added MI (conventional therapy separately). Brain areas activated during MI and real movement show a strong congruity for single arm movement as well as complex whole body movement in stroke patients.[6]

These studies and researchers give evidence that the Motor Imagery with conventional therapy is beneficial in gait rehabilitation. Motor Imagery take less effort and gives motivation to subjects for performing hence easy to apply.

Limitation of the Study:

- Small number of subjects were recruited for the study.
- Stroke subjects were less than or equal to 3 years only.

Future Research:

- The study can be repeated using a large sample size.
- The study can be repeated using subjects with duration of stroke more than 3 years.
- The follow up of the present study can be done.
- Sam study can be done on different

population where gait is affected, e.g. Parkinsonism.

CONCLUSION

As per the results of the present study, Motor imagery program is found to be effective when given with conventional therapy in improving gait in stroke subjects. Moveover it can be done easily by the patient as it takes effort and motivates the subject for performing the desired task. It also does not fatigue the patient. Thus, it is a feasible method and can be applied in conjunction with conventional therapy while treating stroke patients with gait issue.

Clinical Relevance

Motor imagery program can be given together with conventional therapy to improve gait in stroke subjects and it can be done easily as it takes less effort and gives motivation to the subjects for performing tasks. Thus it does not fatigue the patients.

Ethical Clarence: It is a bonafied work done by me and I have not taken any part of thesis from anywere.

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