To the best of our knowledge and within the scope of literature search, this is the first study to evaluate and compare the additional benefits of motor imagery training which involves the lower extremity functional tasks in sit to stand, standing, walking and stairclimbing activities as an adjunct to task specific training. This study also aims at determine these benefits in all the domains of ICF in stroke rehabilitation which includes muscle strength for body structure and function, balance and mobility for activity domain and quality of life for participation in ambulant stroke survivors.

Our study results have shown that across the time measurements from baseline to 3 weeks and 12 weeks follow up a significant improvement was observed in FGA, BBS, isometric muscle strength, gait speed and SIS-16 for both the groups. Between the group comparison, task specific training combined with mental practice group had showed a greater change for all the outcome measures with statistically significant improvement at 3 weeks, 12 weeks from baseline in comparison to the task specific training alone.

Demographic characteristics and clinical status related to stroke

Analysis of baseline characteristics for both the groups (n=38) revealed that they were similar in their demographic and stroke related clinical profile. In the present study, the mean age of study participants is relatively young 54.42 years with 67% of them are reported to be men. The most common risk factors reported in them were hypertension, diabetes, hyperlipidemia with 60%, 40%, 48% respectively. These findings were similar to Pandian and Sudhan, review on stroke epidemiology in India based on recent population studies across rural and urban cities between the 1990s and 2010. This review had addressed the mean age ranging from 54.5 to 67 years with greater prevalence among men. In the stroke subtype, 68-83.6% subjects had ischemic stroke and in the risk factor profile, 54-85% had reported hypertension with 56% had presented with more than two stroke related risk factors.[7]

In the stroke profile 63% of the participants had ischemic stroke and median score of six in NIHSS for both the groups, representing that they were mild to moderate in stroke severity. At the time of study inclusion 62% subjects had post stroke duration with 3-6 months and 38% had more than 6 months respectively. Among them 59% had reached stage 5 and 41% had reached Stage 6 in the brunnstorm motor recovery stage for lower extremity. In the ambulation recovery 63% had level 3, 37% had level 4 of FAC respectively.

Earlier studies have shown that post stroke subjects, reached their motor and functional recovery plateau within 3 months.[201,202] A recent study by Lee KB et al compared the recovery patterns of neurological impairments (trunk control, motor function, sensory, cognition) and functional abilities in ADL and gait across the timespan from pretreatment to 6 months follow up after stroke. This study had concluded that the rate of recovery in all the variables is rapid and ranges from 45% to 70% during first month and further improvement which ranged from 48% to 91% was observed over 3 months. Between 3 and 6 months, the maximum recovery was reported to be 14% in all the variables and least reported was 4% improvement in leg motor score.[203] In the present study, at the time of inclusion the participants had more than 3 months, the gains from the treatment achieved in the study were as a result of the delivered intervention among the groups.

Baseline comparison of outcome measures between the groups

The primary outcome measure (functional gait assessment) and secondary outcome measures (berg balance scale, lower extremity muscle strength, gait speed) did not differ significantly between the groups except stroke impact scale 16. Hence, it can be cautiously stated that the groups were homogenous in nature and comparable at the baseline.

Strength impairments between the weaker and stronger side

Isometric strength measurement in our study had observed that the mean strength values for all six major lower extremity muscle groups in the weaker side, is significantly lower than the stronger side with $p<0.001$. The mean degree loss of strength in the paretic extremity varied from 26.7% to 42.7% on the stronger side. These findings also observed that the loss of strength is more pronounced in proximal and distal group of flexors muscles.

Previous investigations on distribution of post stroke lower extremity muscle weakness suggested that extent of strength deficit in paretic limb is strongly associated with severity of stroke and their functional level.[204,205] Our study results are similar to Dorsch S et al reported the mean strength loss of the paretic lower extremity muscles in ambulatory chronic hemi paretic subjects using HHD ranged from 34% to 62%, compared to age and gender matched control participants.[206]

Moderating factors to influence the effectiveness of TST

The results of this study demonstrate that 3 week (18 sessions) of TST had found significant improvement in all the outcome measures addressed in this study.

When compared to previous studies, TST delivered in this study had incorporated Challenge Point Framework (CPF) model for motor learning principles to manipulate and modify the functional task difficulties involving lower extremity motor tasks with the intended goal of balance and mobility functions in ambulant stroke survivors. The CPF components incorporated in our study were active participation of the stroke subjects to enhance problem solving approach related to their motor impairments, therapist guidance during motor performance associated with augmented feedback (KR and KP) and organization of practice schedules which included blocked practice in initial learning sessions, progressed by random practice to improve motor learning and enhance skill transfer in balance and mobility functions. Studies have shown that the clinical application of CPF was found to be an effective approach to reach optimal challenge for motor learning.[207,208] A recent study by Pollock CL et al had incorporated CPF to improve balance functions in chronic stroke subjects and concluded that the CPF model of motor learning application, found to improve walking balance abilities and provide a valid progression method for functional task training in stroke rehabilitation.[209]

Lower extremity TST addressed in the present study could have induced use dependent neural plasticity changes[210-12] resulting in sensorimotor adaptation with respect to upright postural stability, anticipatory and reactive postural adjustments and the timing and composition of neuromuscular coordination for the successful performance of that functional task.

To further enhance the training effect, TST progam was started with gross isolated movements/activities to improve basic mobility functions, graded with goal oriented activity based movements/activities and further added with meaningful activities related to daily life. These activities were aimed to promote dual motor tasks concurrently and to integrate natural motor control mechanism between paretic extremities (upper and lower) and trunk functions to improve their performance in ADLs and community participation. Studies have shown that training components involving dual motor task and meaningful task specific activities provide increased cortical reorganization in the motor cortex and functional recovery in stroke rehabilitation.[213,214]

Many studies have reported that static and dynamic balance ability of stroke subjects had a strong association with gait related mobility functions. In our study participants were also trained with more challenged and demanding locomotor tasks such as walking up and down stairs, an important element for independent in ADL activities and for a good social life. Studies have shown that negotiating stairs exercises improves trunk and pelvic stability and also redistributes weight bearing ability on paretic limb with reduced postural sway.[215,216] Stair climbing activity also increase the limits of stability during transitions, with more demand on postural muscles in the paretic lower extremity to improve postural stability and recovery in dynamic balance abilities.[215-18]

Moderating factors to influence the effectiveness of mental practice with motor imagery

MI training integrates cognitive elements associated with motor learning to enhance motor performance and skills. It promote CNS neural plasticity both structural and functional reorganization after neurologic conditions which include stroke.[219] Studies have shown that number of repetitions in the practice of task specific interventions is one of the important factor to drive neural reorganization for optimal functional recovery during stroke rehabilitation.[220-22] In the present study task specific physical practice combined with mental practice could facilitate multiple repetition of movements/tasks at cerebral level, could enhance the input from supplementary and premotor areas to primary motor cortex for new functional motor architecture. MI can unmask the silent synapses and also increase the work load of the remaining active motor related neural networks in the damaged primary cortex to generate motor output in the most efficient way. These facilitations could strengthen the cortico-cortical connectivity for greater amount of reorganization and functional gain in the mental practice group.

A recent systematic review of fMRI studies have reported that modulation of interhemispheric activation balance (IHAB) in motor-related cortices which include premotor cortex (PMC), supplementary motor area (SMA) is an important determinant for post stroke motor recovery.[223] Recent studies on fMRI on post-stroke subjects have found that neural correlates of Motor imagery found to activate these cortico motor neural networks and also modulate IHAB to improve functional recovery.[224,225]

In the present study, MI interventions are mediated by five major potential variables which can be classified into: a) participants MI abilities, b) familiarizing them with BAC addressed to paretic lower extremity and motor imagery concepts, c) motor imagery perspective, d) mode of delivery and e) volume of training. These variables could have result in an effective imagery intervention to produce larger effect in study related outcome measures.

a) Participants Motor Imagery abilities

Age

At the time of study, inclusion the combined physical and mental practice group had participants with mean age of 55 years. In a study to determine if there is a progressive decline in motor imagery performance with aging, had reported that up to the age of 70 there were no notable deficits in working memory in healthy older adults and they had better representations in visual and kinesthetic imagery abilities.[226]

In the present study, Mental Practice group had 63% of the participants with left sided hemispheric stroke. Previous studies on motor imagery abilities have reported that, compared to subject with right hemispheric lesion, subjects with left hemispheric lesion had greater visuospatial working memory skills and they were also found to be good with imagery abilities to reproduce vivid images, temporal congruency with real and imaged movements.[227-29]

b) Familiarization with BAC

Motor performance is influenced by motor learning and mental practice. It enhances the process of learning by strengthening the mental representation networks comprised of perceptual-cognitive units of motor actions (i.e., BACs). Studies have shown that combined with physical practice, these representations were modified and adapted which were associated with functional organization in long term memory for learning complex movements/tasks.[194,230,231] BAC incorporated in our study could enhance the motor representation for the tasks which were involved in actual task performance and strengthened their motor memories to facilitate for true motor recovery and functional outcome as compared to other MI treatment protocols mentioned in the previous studies.

c) Perspective

Motor imagery as third person perspective (visual imagery) implies self-visualization i.e., visual observation of one's own physical behavior, could activate mirror neuron system mechanism in the premotor area and the parietal lobe resulting in imitation learning.[232-34] This learning may recover the lower extremity motor ability in stroke rehabilitation as results from earlier studies have shown that MNS found to improve motor memory formation as well as the quality and quantity of the movement to improve the performance.

Kinesthetic imagery as first person perspective (feel the movement) involve imagining the motor act within the body to experience kinesthetic sensations related to information about the positions and movements of limbs and the exerted muscle forces associated with that movement. Neural substrates with regard to kinesthetic imagery demonstrate different brain activity and neural processing to enhance motor performance and learning. Kinesthetic stimulation enhances more stable representation of the movement pattern to consolidate the motor memory process to facilitate motor skill acquisition. Kinesthetic stimulation also enhances more stable representation of the movement pattern in the motor memory process to facilitate motor skill acquisition and retention.[235]

d) Mode of delivery

Added MI

Combined with lower extremity task specific training, the neural correlates of motor imagery intervention may produce priming effect on functional (goal-directed activity) and behavioral aspects of movements (movement quality). Motor imagery sessions addressed in this study were added before physical practice sessions to enhance our participant's concentration during mental practice with minimal physical fatigue. This is supported from Nagano K et al where it was reported higher concentration level during mental practice may have a larger effect to improve motor performance in individuals with post stroke hemiparesis.[236]

Embedded MI

In the present study, MI training was progressed with embedded MI sessions (dynamic imagery) coupled with physical practice using PETTLEP model to reinforce MI quality and its efficacy. Integrating this training method could improve arousal attention component, somatosensory feedback to facilitate the mental representation for the selected functional tasks. Schuster C et al compared two modes of MI integration strategies (added vs embedded) to relearn complex mobility task 'going down, lying on the floor, and getting up again' in post stroke subjects, concluded that additional six sessions of 15 to 20 minutes MI training resulted in similar effects for the time taken to execute the task. The results of this study should be interpreted cautiously as it fails to implement key moderating factors such as age, MI familiarization phase and low intensity of MI dosage in training sessions.[237]

e) Volume of training

The motor imagery training group received guided audio taped instructions for 15 minutes added before physical practice, progressed with embedded MI training sessions where series of physical and mental repetitions were delivered concurrently. A recent systematic review on motor imagery training elements reported that positive results in all the MI interventions suggest an average of 15-20 minutes for each MI training session being optimal to maintain participant's motivation and avoid mental fatigue.[59]

Combined with task specific training, our participants also received higher mental practice duration of 60 minutes on every day for 12 sessions over 2 weeks. In a study to evaluate and compare the impact of various mental practice durations (20, 40, and 60 minutes) combined with 30 minutes of repetitive task-specific practice sessions had reported mental practice administered for 60 minutes found greater gain and significantly improved upper extremity functions in post stroke subjects.[238]

FGA

In previous RCT studies on additional motor imagery training on gait performance in stroke subjects, the physical practice group was trained with Bobath concept, treadmill training, placebo-controlled upper extremity interventions, task oriented circuit class training and regular physical therapy. Among these studies, the delivered motor imagery training, focused with walking related activities, with delivered therapy dosage varying from 12 to 30 sessions for 2-6 weeks with each session lasting for 15-30 minutes, reported with the maximum follow up period of 6 weeks post intervention. To summarize these reported trials poorly reported mental practice framework and also had diverse difference in the elements of delivered MI training (selection of participants, mode of delivery, mental rehearsal). They also failed to incorporate all the key steps involved in mental practice framework and how to integrate any specific model to maximize its efficacy to improve gait performance.

In the present study, FGA- a performance based test was used to assess the postural balance and gait related mobility functions in ambulant stroke subjects both quantitatively and qualitatively. Across the time measurements, the median change score for FGA found to be a statistically significant change for within group comparison with p value 0.001 which suggest that critical elements as addressed earlier in TST could have contributed towards the present findings.

In the comparison between groups this change score across the time measurements was also found to be statistically significant change compared with physical practice with p value <0.001.The possible mechanisms for improvement in the physical plus mental practice group are as follows: a) participants were trained with BACs for sit to stand, walking and stair climbing activities which may contribute for cognitive-perceptual adaptations process to improve the motor performance and relearn the motor skills related to balance and mobility functions b) the primary goal of any stroke rehabilitation is to reorganize the disturbed motor network either directly or indirectly to regain motor functions. Mental practice with MI found to be a cognitive stimulant to facilitate the interaction among damaged motor networks involved in motor planning, programming, and initiation to simulate motor performance in stroke rehabilitation.[239] During mental rehearsal, this interaction between the motor neural networks could access the representational aspect of voluntary movement, which is accompanied and preceded by postural control adjustments. MI tasks addressed in this study might produce an effective brain connectivity to modulate the postural control mechanism with appropriate muscles synergies and neuromotor coordination for better outcome. The present findings is supported by de Souza NS et al systematic review on postural modulation during motor imagery tasks.[240]

Studies have shown that Kinesthetic MI involving bilateral rhythmic lower extremity tasks found to modulate postural parameters observed in CoP displacements and reaction time.[241,242] Motor representation generated by Kinesthetic MI recruits other motor-related areas, such as the basal ganglia for movement planning and cerebellum for kinematic and timing parameters which forms the basis for subliminal and unintentional postural adjustments during MI and could have attributed for the present findings.

Recent fMRI studies to explore cerebral activity, functional connectivity and to identify the neural substrates for MI involving dynamic balance tasks have found MI recruited fronto-parietal regions, basal ganglia, medial cerebellum which are primarily responsible for active maintenance of body balance, automatic and anticipatory postural responses to regain balance. These findings also highlighted that MI enhances the functional connectivity with the supplementary motor area, the mesencephalic locomotor region MLR, thalamus and basal ganglia to modulate postural stability in gait related motor imagery tasks.[243,244]

BBS

In the previous RCT studies on additional motor imagery training on balance ability in stroke subjects, the balance training was focused on unstable surfaces, proprioceptive exercises, neurophysiological approach and treadmill training. In these studies, the delivered motor imagery training were focused with activities in standing such as weight shifts, squatting, reaching and walking activities with delivered therapy dosage varying from 12 to 40 sessions for 4-8 weeks with each session lasting from 5-30 minutes and reported with the maximum follow up period of 6 weeks post intervention. In summary, the delivered MI program in these reported trials had limited tasks related to balance functions and also lack detail in the description of the motor imagery intervention.

BBS was used to measure balance related impairments in our study. Across the time measurements, the median change score for combined physical and mental practice found statistically significant change compared to physical practice with p value. In our study, the imagined movements were challenged with specific balance issues (e.g., lateral reaching in standing, marching) and earlier studies have reported that forward internal models generated during motor imagery could potentially change muscle spindle sensitivity by fusimotor neuron activation to modulate postural sway (COG dynamics) in a task-specific manner and may influence balance functions.[245]

Postural control mechanism and balance control can be influenced by two distinct neural mechanism involved in visual and kinesthetic MI. The visual MI found to facilitate the mirror neuron networks for action learning through observation and kinesthetic MI to modulate the conscious awareness of internal sensory information regarding joint movement and position sense (proprioception), which were practiced during task specific training could have resulted in the present findings.[246]

Isometric Muscle Strength

To address body structure/function domain of ICF, isometric muscle strength of lower extremity muscles was assessed using portable Hand Held Dynamometer.

Post intervention, task specific training addressed in the present study had found a significant improvement in strength gain for six major paretic lower extremity muscle groups for both the groups. The strength gain addressed in the present study could have resulted from neuromuscular adaptations in the lower extremities as the task components involved activities in sit to stand, stepping, walking and stair climbing which demands interactions of multi-segmental lower extremity kinematics, joint dynamics, and muscle activity. Practice of these context-specific functional task could have driven sufficient voluntary muscle force for neuromotor coordination in the paretic extremity.

Our study results were similar to previous RCT studies on task oriented strength training/functional strength training to improve lower extremity muscle strength in subacute and chronic stroke subjects. Bale M and Strand LI included 18 subacute stroke subjects to compare traditional therapy using Bobath concept with functional strength training stated that 10-15 repetitions of graded activities or sequences of activities in the paretic leg as functional strength training delivered for 50 minutes a day, five days a week, for 4 weeks found to improve isometric knee muscle strength of flexors and extensors in the paretic extremity.[92]

YR Yang et al conducted 12 supervised sessions of task oriented progressive strength training which incorporated lower extremity functional tasks in sit to stand and standing activities reported that the experimental group had isometric strength gain ranged from 10.1-77.9% on the paretic muscle groups with carry over effect on gait and balance performance.[55] However these results should be interpreted cautiously as the control group did not receive any intervention and no follow up.[91] Post intervention, the improvement in strength gain in our study had ranged from 3.3% to 34% as we progressed the training sessions with variability in task practice, to improve motor learning and focused to retrain their balance and mobility functions with less emphasis on repetition maximum or to add any resistance in the extremities to challenge their performance.

Motor imagery and Strength performance

Mental practice found to have significant impact in increasing or preserving muscle strength in healthy participants, athletes and elderly individuals. However, till date, there are no retrievable studies to report benefits of strength gain in stroke rehabilitation. Compared to the physical practice group, our results had shown significant improvement and favorable outcome in physical plus mental practice group to regain isometric strength gain for lower extremity paretic muscle groups. MI perspective with respect to muscle strength could be explained in terms of neural adaptation and higher muscle excitation.

Neural adaptation

MI training found to reinforce the level of neural activity involving motor cortical circuitry to recreate the sensory-visual representation and kinesthetic feeling related to the trained movements/tasks. Studies have shown that amount of cortical activity modulates the voluntary muscle force and facilitates further strength gain in stroke survivors.[247,248]

In the present study, the neural adaptation following MI training could increase the magnitude of cortical potentials generated in motor cortex neural circuits and discharge stronger brain to muscle signals to modulate corticospinal excitability to the targeted muscles involved in the MI functional tasks. These descending commands might recruit inactive motor units and/or drive the active motor units to higher intensity for maximum voluntary contraction which might induce greater isometric strength gain in them.[149,249,250]

Another possible mechanism to relate MI and muscle strength relationship is based on psycho-neuromuscular theory, which states that, mental practice training involving particular movement activates same neuromotor pathways and also found to elicit subliminal electromyographic (EMG) activity of the same target muscles corresponding to actual motor execution.[251] Mental simulation facilities cortical excitability to strengthen the motor program with priming effect on corresponding motoneurons of the same muscles resulting in higher muscle excitation and directed towards force production.[252,253]

Gait Speed

Ten meter timed walk test (10MTWT) was used as a secondary outcome measure to address gait velocity under activity domain of ICF. From baseline to follow up improvement in gait speed was ranged between 13.5% and 31.3% for both the groups and also found to be statistically significant for comparison within the group, suggesting thatthe delivered TST found to recover post stroke mobility functions related to walking ability.

Post stroke impairments in balance/postural control and paretic lower extremity muscle strength are the most important factors to determine gait performance in velocity and symmetry.[254,255] In the present study, task specific training programs incorporated intensive practice of lower extremity functional mobility tasks to gain optimal control strategies for balance motor control and also functional ways of strengthening the paretic muscles which could lead to a greater carryover effect to change the walking capacity of the participant.

Coordinated gait pattern is also requisite for walking adaptability to environmental demands and to reduce the risk of falling and energy cost in post stroke individuals. Deficits in gait symmetry (integration and sequencing of action within and between the limb/s, respectively) are characterized by altered spatiotemporal coupling in single or double-limb support time, step lengths, stance and swing phase manifested as reduced walking speed and endurance among stroke subjects.[256] In the present study task specific activities involving rhythmical reciprocal pattern such as walking and stair climbing can promote inter-limb coordination, gait symmetry to achieve optimal gain in the ability to walk. A recent systematic review by Hollands KL had concluded that task specific practice was found to be a promising approach to restore gait coordination coincided with increased walking speed to improve overall walking ability post-stroke.[257]

In the comparison across the groups, combined physical and mental practice group had mean difference (SEM) of 0.16 m/s from baseline to post treatment and follow up and also showed statistical significant difference compared to physical practice group. Positive effect of motor imagery intervention on gait velocity could have resulted from priming neuromotor pathways related to walking as brain imaging studies have confirmed the functional similarities with real and imagined walking.[258] MI training also induces neural coupling at supraspinal level by activating dorsal premotor cortex, posterior parietal cortex, supplementary motor area (SMA), cerebellum, and mesencephalic locomotor region for task-specific inter-limb coordination which might have contributed towards an increased walking speed for the present findings.[259]

MIT delivered in this study, also incorporates rhythmic auditory step rhythm using metronome beat to enhance the imagined walking speed which might have contributed towards additional benefits on walking performance. Our findings are supported from Thaut et al and Hwang S et al who have shown that rhythmic auditory stimulation using metronome found to improve hemiparetic gait with spatiotemporal parameters and greater muscle activity in the paretic limb.[158,260] However these findings should be cautiously interpreted as the mean difference (SEM) reported in gait speed did not exceed the MCID value 0.17 m/s to consider as clinically important change addressed for improvement in walking ability.[261]

Quality of Life

Stroke Impact Scale-16 was utilized in the present study to measure quality of life under physical domain. Across the time measurements, improvement in the median change scores for SIS-16 found statistically significant difference for both the groups ($p<0.001$) favoring the possible benefits of TST to improve physical performance in daily activities such as dressing, personal care and mobility skills such as reach out in sitting/standing, walking and stair climbing.

Balance self-efficacy is the confidence level of not losing balance or maintaining steadiness while performing daily functional and mobility tasks. It is an important psychological factor to mediate a greater recovery in physical functions, community reintegration and also a strong predictor for HRQOL in stroke survivors.[262-74] TST delivered in the study had incorporated necessary elements of social cognitive theory, such as mastery experience (to provide opportunities for task practice that challenge balance and mobility functions and progression in a graded manner for successful performance), verbal persuasion about outcome and quality of the movement (Knowledge of Result and Knowledge of Performance) might have brought changes in their affective state to influence their balance self-efficacy which may attributed for positive improvement in health status and quality of life in both the groups.[265]

Across the group comparison combined physical and mental practice group had statistical significant difference in median change score of SIS-16 from baseline to post treatment and follow up. The possible reasons for the results could be the delivered MP Sessions had incorporated motivational imagery strategies postulated from attention-arousal theory aimed to engage participants in an optimal state of arousal and attention to process the cognitive information regarding task performance.[266] The PEETLEP model further build up psychological experience for the participants to reach the threshold level of activity/task with increased confidence level to enhance their performance. These elements could have improved a subject's mental confidence in problem solving ability, decision making and to develop autonomy which has been associated to improve performance and self-efficacy. This psychological characteristic of self-efficacy is important as it address participant's confidence level to execute different activities of daily living (ADLs) independently without losing balance (balance self-efficacy) or falling (falls self-efficacy), with motivation, self-confidence and could have influenced our study findings. A recent systematic review by Tang A et al to examine different interventions on balance efficacy in stroke population had found that interventions that concurrently address physical and cognitive factors may yield greater benefits in balance self-efficacy.[267]

Feasibility analysis

Feasibility was checked using informal interview of patients. Exit interview comments were positive and satisfactory with the delivered program. This is further confirmed by a good adherence of the patients in the exercise program and also on looking at no adverse events reported by participants of both the groups in the present study.

Retention effects

Between groups comparison the results had observed no statistically significant difference in performance based functional outcomes and strength gain from post intervention to follow up. This suggest that no decrease in these effects was disclosed at follow-up and there were better retention effects for additional motor imagery practice combined with physical practice. Potential mediators integrated in motor imagery training could contribute tothe present findings and may account for the positive benefits observed.

Active participation and adherence with the prescribed home based exercise program could have also influenced to retain the functional gain for both the groups. TST training sessions delivered in this study had explored the feasibility of prescribing individualized activity log for the participants to continue exercise in their own homes as independent practice sessions during non-therapy days. Adopting this method of training might have provided the flexibility to therapist with limited time constraints and might have also avoided excessive physical fatigue, muscle soreness for participants, could have benefited for optimal compliance in the present study. Further evaluation on frequency of independent practice sessions taken from the activity log book had shown that our participants are highly motivated and adhere to the training program.

Social support from family members and participant's motivation for independent practice are found to be important facilitators for compliance and adherence when it comes to therapy attendance, amount of practice for both the groups. Motivation and Social support are found to crucial elements for any successful rehabilitation, which could contribute to achieve and maintain the therapeutic benefits addressed in the present study.[268]

Though the present study showed a statistically significant improvement from baseline to follow up, most of the positive changes noted at the end of training program (3 weeks) were failed to maintain at follow up assessment at 12 weeks for both the groups. This suggest that our intervention related improvement are possibly waning of over time or the intensity of the delivered training program might have not been sufficient so as to sustain the treatment effects for longer duration.