Journal of Novel Physiotherapies

Kumar and Monika, J Nov Physiother 2014, 4:3
http://dx.doi.org/10.4172/2165-7025.1000216

Research Article Open Access

Effectiveness of Mental Practice Combined with Physical Practice in the Treatment of Post Stroke Patients

Chandan Kumar[1*] **and Monika**[2]

[1]*Associate Professor, MGM'S Institute of Physiotherapy, Aurangabad, Maharastra, India*

[2]*Clinical Psychologist, MGM'S Institute of Physiotherapy, Aurangabad, Maharastra, India*

[*]**Corresponding author:** Chandan Kumar, Associate Professor, MGM'S Institute of Physiotherapy, Aurangabad, Maharastra, India, Tel: 91-8087518006, 7773923831; E-mail: ptchandan221@yahoo.co.in

Rec Date: Jan 31, 2014, **Acc Date:** June 30, 2014, **Pub Date:** July 3, 2014

Abstract

Purpose: To determine the effectiveness of mental practice combine with Physical practice in post stroke patients.

Methodology: This was an experimental study of 30 stroke patients having first ever unilateral stroke. All the subjects were enrolled in identical subgroup and divided into two equal group one experimental and another control group. Experimental group did 30 to control group and displayed efficient improvement in motor function of the upper extremity after 6 weeks.

Conclusions: Mental practice with physical practice is more effective than physical practice alone, thereby providing evidence that it is a better strategy to include mental practice in combination with physical practice in stroke minutes mental practice followed by 30 minutes physical practice and control group performed 30 minutes physical practice. After completing 6 weeks of intervention in both the groups, posttest measurement done with Fugl-Meyer Assessment (FMA) scale.

Results: The result obtained from the study demonstrated that experimental group showed significant results as compared rehabilitation.

Keywords: Stroke; Mental practice; Physical practice; Upper extremity

Introduction

Stroke or Brain attack is the sudden loss of neurological function caused by an interruption of the blood flow to the brain. The term Cerebrovascular accident is used interchangeably with stroke to refer to the vascular conditions of the brain [1]. According to World Health Organization 'stroke is defined as rapidly developed clinical sign of a focal disturbance of cerebral function of presumed vascular origin and of more than 24 hours duration'. Included within this definition are most cases of cerebral infarction, cerebral haemorrhage and subarachnoid haemorrhage but deliberately excluded are those cases in which recovery occurs within 24 hours [2].

Stroke is third leading cause of death and the most common cause of disability among adults worldwide [3]. The prevalence of stroke in India varies in different regions of the country and ranges from 40 to 270 per 100,000 population [4], approximately 12% of all strokes occur in the population <40 years of age [5]. The National Commission on Macroeconomics and Health has projected that cases of stroke would increase from 1,081,480 in 2000 to 1,667,372 in 2015 [6].

Ischemic stroke is the most common type, affecting about 80% of individuals with stroke, and results when a clot blocks or impairs blood flow, depriving the brain of essential oxygen and nutrients [7]. Haemorrhagic stroke occurs when blood vessels rupture, causing leakage of blood in or around the brain [8].

Involvement of upper limb in stroke

The paretic upper limb is a common and undesirable consequence of stroke that increases activity limitation. It has been reported that up to 85% of stroke survivors experience hemiparesis and that 55% to 75% of stroke survivors have continued to have limitations in upper-extremity functioning [9].

Stroke induced affected arm nonuse often causes greater motor disability to be exhibited than that which actually exists and this can produce affected limb bone and muscular atrophy [10]. Learned non-use is hypothesized to result from a psychological process in which attempts to use the affected arm during acute and sub-acute stages after stroke are 'punished' by a failure [10]. It is therefore important to continue to search for new therapy techniques to improve recovery.

Over 50% of patients with upper limb paresis resulting from stroke face long-term impaired arm function and ensuing disability in daily life. Unfortunately, the number of effective treatments aimed at improving arm function due to stroke is still low [11]. Impairments related to stroke affect motor-sensory, cognitive and psychological functions. Among these, the most common is undoubtedly hemiparesis. Upper limbs motor impairments can also affect global functional recovery. In order to overcome this obstacle, rehabilitation

methods, which specifically address the recovery of upper limb function in stroke patients, have been introduced [12].

Mental practice

Richardson provided the standard definition of mental practice as "the symbolic rehearsal of a physical activity in the absence of any gross muscular movements". This approach has also been variously called imaginary practice, covert rehearsal, symbolic rehearsal, and introspective rehearsal, or conceptualization [13].

Mental practice refers to the cognitive rehearsal of a task in the absence of overt physical movement. When a musician practices a passage by thinking it through or when an athlete prepares for an event by visualizing the steps required performing the task, he or she is engaging in mental practice. The duration of the mental practice intervention varied across studies from 30 seconds to 80 minutes [14].

Mental practice and physical practice also lead to plastic changes in the motor cortex area of the brain [15]. Functional recovery is attributed to reorganization processes in the damaged brain. Within-system reorganization (self-organization) may be possible when damage to a functional system is partial.

Methodology

Thirty subjects, both male and female selected by means of simple random sampling from MMIMSR hospital based on inclusion and exclusion criteria. Patients randomly allocated into two groups.

Inclusion criteria

1. First Stroke
2. 40-70 years of age
3. Willing to participate in 6 weeks intervention
4. Unilateral upper limb paresis
5. Minimal or no sensory deficit
6. Must have CT or MRI with them

Exclusion criteria

1. Stroke occurred less than 4 weeks or more than one year
2. Aphasia
3. Inability to sit
4. Cognitive impairment (MMSE<23)
5. Excessive spasticity or pain at elbow, wrist or hand (MAS>2)
6. Any cardiovascular, orthopaedic or neurologic impairment other than stroke
7. Upper extremity impairment level (FMA<11)

Procedure

Total 38 patients were selected and out of which 5 were excluded because they refused to participate in the study and 3 were having cognitive impairment, so 30 subjects were randomly allocated according to criteria. Demographic details of subjects that include age, gender, affected side etc were collected. Patients were assigned randomly into group A and group B. All patients were evaluated by Fugl-Meyer Scale (FMA) which is a valid and reliable tool for measuring recovery following a stroke [16,17], Modified Ashworth Scale (MAS) which is remain the primary clinical measures of tone [18,19] and the most widely used Mini-Mental State Examination (MMSE) scale screening tests to provide brief, objective measures of cognitive functioning [20,21].

The procedure of the study was explained to the subjects and written consent was taken. Group A subjects were instructed about the procedure by making them aware of the fact that there is an audio recording which they have to listen and they are not supposed to perform the activity, they just have to imagine the task.

Treatment (Physiotherapy)

Experimental group

Mental practice: Relax yourself, Sit comfortably by easily supported yourself, slowly and slowly close your eyes completely. Now take deep breath and then gently exhale out breadth, Inhale and exhale deeply. Repeat this 2-3 times. Imagine that you are in a peaceful and safe place, See green plants and feel great weather, try to visualize a clear picture. Look at to your eyes, they look relaxed, your whole body looks calm. Now time for contracting the muscles. Imagine that you are sitting on a chair and there is a table lying in front of you having a mug place over it. Contract your hand muscles then forearm then upper arm and finally shoulder. Now feel that your hand try to reach for that mug by lifting your arm, extending your elbow and fingers. Try to imagine the movement in a slow motion and stay relaxed like that till the end of the session. Good going. Pay attention and grasp that mug, Sense the feeling of holding and grasping that mug. Now take that mug close to your mouth. Relax and make yourself comfortable and Place that mug to the same location. Again repeat the whole procedure of grasping and holding the mug. Now we are coming back to the surrounding of this room, listen to the noises surrounding you. Follow my count from 5 to 1, when I say 1 open your eyes. 5,...4,...3,...2,...1.

Mental practice continues in increasing speed and complexity of tasks with the Corresponding weeks.

During physical practice session emphasis was on performing task oriented activities:

Writing

Self-feeding

Reaching for a thing placing over shelf forward

Folding and hanging towel

Turning pages

Opening and closing lock

Cutting fruit Combing Buttoning

Tie shoe laces

These Task oriented training using functional meaningful activities to improve functional performance. The use of real, functional objects also showed evidence as an effective method to enhance efficient, smooth, and coordinated post-stroke upper extremity movement. This helps in preventing contractures and development of abnormal postures. These exercises start with simple movements and subsequently complex movements and actions are tried [22,23].

Control group

The physical practice session is same for them as for those in mental practice group. After completing 6 weeks of intervention in both the groups, posttest measurement done with FMA scale.

Ethical clearance for the study was obtained from the ethical clearance committee of, Maharishi Markandeshwer Institute of Physiotherapy and Rehabilitation, M.M. University, Mullana, Ambala, Haryana, INDIA.

Data and Statistical Analysis

Comparison was performed between both the group's first at baseline level then analyzed from baseline to the end of 6th week for each group, and finally at the end of 6 weeks. Data analysis was done using SPSS version 16, software package. Mean and standard deviation were used as descriptive statistics. Data was tested Non parametrically to determine the Effect of Mental Practice combined with Physical Practice in the treatment of post stroke patients for upper extremity functional recovery. Wilcoxon signed rank sum test was used to compare within group values. Mann

Whitney U test was used for between group comparisons. The level of significance was set at $p<0.05$.

Result

Fifteen subjects were taken in each group with mean age of 59.00 ± 9.27 and 58.33 ± 9.29 in Group A and Group B respectively. There is no statistically significant difference between both the groups that is they are matched for baseline characteristics (Table 1).

	Experimental (Group A)	Control (Group B)
Number of patients (n)	15	15
Age (Mean ± S.D)	59.00 ± 9.27	58.33 ± 9.29
Mean Difference	0.667	
t value	0.197	
Result	Not-Significant	

Table 1: Age distribution of participants in the study (n=30)

A total of 22 males and 8 females participated in the study. Group A consisted of 3 left sided and 12 right sided affected patients. Group B consisted of 4 left sided and 11 right sided affected patients.

In Group A, 80% patients were right side affected and remaining 20% patients were left side affected whereas in Group B, 73% patients were right side affected and remaining 27% patients were left side affected.

Groups	Gender		Side affected	
	Male	Female	Right	Left
Experimental (Group A)	10	5	12	3
Control (Group B)	12	3	11	4

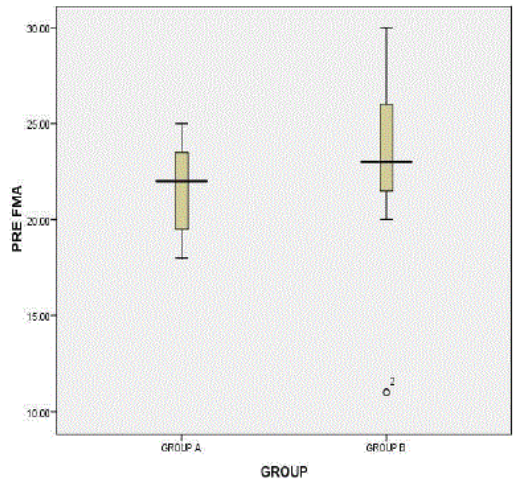
Table 2: Gender and Side affected in both the groups

In Group A, 67% were male and 33% were females whereas in Group B, 80% were males and 20% were females. No statistically significant difference was found between the groups showing that subjects are matched for baseline characteristics (Table 2).

Mann-Whitney U test has been used to compare the median of Pre FMA score between Group A and Group B. Group A pre FMA value is 22.00 ± 4.00. Group B pre FMA value is 23.00 ± 4.50. The results revealed non-significant difference between pre FMA measurements in both the groups at $p<0.05$ (Table 3 and Figure 1).

	Group A (Experimental)	Group B (Control)
Pre FMA (Median ± Range)	22.00 ± 4.00	23.00 ± 4.50
U value	80.5	
Result	Not significant	

Table 3: Median, Interquartile range, U value of Pre FMA score between Group A and Group B



Above graph is showing median value by FMA at 0 week

Figure 1: Comparison of baseline readings between both the groups, graph is showing median value by FMA at 0 week.

Mann Whitney U test has been used to compare post FMA score between Group A and Group B. Group A and B post FMA value are 30.00 ± 3.00 and 27.00 ± 4.00. The results revealed significant difference in both groups because test value is less in both the groups than the table value at 0.05 (Table 4 and Figure 2).

	Group A (Experimental)	Group B (Control)
Post FMA (Median ± Range)	30.00 ± 3.00	27.00 ± 4.00
U value	44.0	
Result	Significant	

Table 4: Median, Interquartile range, U value of post FMA score between Group A and Group B

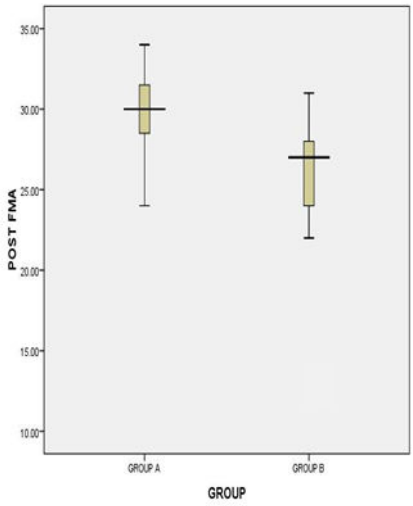


Figure 2: Comparison of after intervention readings between both the groups, graph shows median value by FMA after 6 weeks

Wilcoxon signed rank sum test has been used to compare Pre-Post FMA score within Group A and Group B. Pre and post FMA value are 22.00 ± 4.00 and 30.00 ± 3.00 within Group A. Pre and Post FMA value are 23.00 ± 4.50 and 27.00 ± 4.00 within Group B. The results are significant within the groups (Table 5 and Figure 3).

Groups	Pre FMA (Median ± Range)	Post FMA (Median ± Range)	Z value	Results
Group A (Experimental)	22.00 ± 4.00	30.00 ± 3.00	0.0	Significant
Group B (Control)	23.00 ± 4.50	27.00 ± 4.00	0.0	Significant

Table 5: Median, Interquartile range, Z value of Pre-Post FMA score within the Groups

Discussion

The present study deals with the effect of Mental Practice (MP) along with Physical Practice (PP) and physical practice alone in post stroke patients.

When analysis was done for demographic information of participants, no statistically significant difference was found showing that subjects are matched for baseline characteristics. There is no significant difference between pre FMA score in both the groups at baseline level. There is statistically significant difference within pre and post FMA score in both the groups, which shows that mental practice combine with physical practice and physical practice alone both are effective in post stroke patients.

When comparison was done between post FMA score in both the groups it was found that after 6 weeks of intervention experimental group has better prognosis than control group.

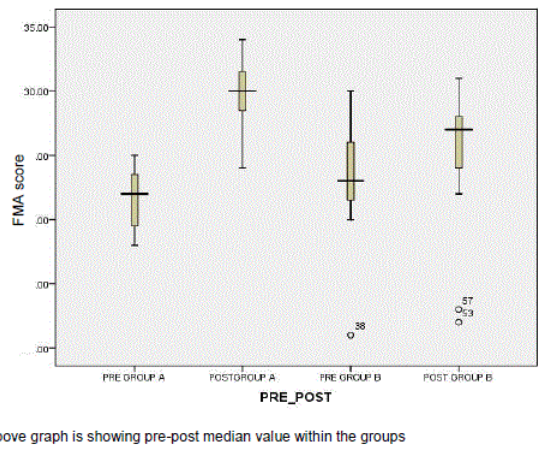


Figure 3: Comparison of within groups reading of both the groups

Although upper limb function improvements were seen in both the treatment group (physical practice alone or combined together with mental practice) in post stroke patients but it was seen in this study that when physical practice combined with mental practice (or mental imagery) in the treatment protocol, a greater amount of improvement in upper limb function was noted after 6 weeks of intervention. Therefore the null hypothesis is rejected and thus the alternate hypothesis is accepted.

The changes were found in this study clinically significant. Indeed after intervention, patients reported performing Activities of daily living (ADL's) with their affected hands.

Finding of this study is supported by previous case report done by Stephen J Page et al. who suggested that that mental practice is a potentially useful method of practicing motor skills [24].

Similar finding where functional improvements were also consistent with the speculations of Page, who suggested that functional outcome could be enhanced by mental practice and they were consistent with functional improvements observed in other mental practice studies [25-27].

Magill [28] suggested that mental practice is effective because it augments existing motor schema, subjects participating in a regimen combining mental practice and Physical practice showed large reductions in affected arm impairment as measured by the FMAS, and large increases in movement as measured by the ARAT [25].

The reason behind better improvement in mental practice group is thought to provide its impact by atleast 2 independent but interrelated mechanisms. First, stroke patients have been shown for decades to not use their more affected arms, even when capable of doing, a phenomenon traditionally termed "hemiakinesia", However, MP use was recently shown to increase affected arm use, thus overcoming this movement suppression phenomenon [29].

The second hypothesized mental practice mechanism is use-dependent brain reorganization, in which new cortical areas are recruited to assist in movement of the affected arm. Results of Previous study show that this phenomenon occurs with a variety of task specific protocols, even of a brief duration, including mental

practice, and that motor changes co-relate with cortical changes [30,31].

Frequent practice of a skill causes improved motor performance. Mental practice, when combined with physical practice, has been shown to be even more effective in improving motor performance than physical practice alone. One viable hypothesis for this effect is that, during mental practice, concurrent activity occurs in the musculature and in the appropriate neuromotor pathways [32-36].

This correlative neuromotor activity occurs with repetitive physical practice and is responsible for the motor performance improvements that individuals exhibit after mental practice. It was also believe that the patient's improvements between the pretests and the posttest occurred because the patient, through mental practice, was provided with additional practice of functional tasks using the affected arm.

On a physiological level, we believe that this practice caused priming of the motor cortex and appropriate activation of the neuromotor pathways, which resulted in the patient's improvements.

Another reason behind better recovery in experimental group may be due to additional feedback such as auditory which was provided, improves motor learning. Feedback can inform individuals about the accuracy and progress of their performance. In addition, feedback can motivate them by affecting their perceptions of competence and accomplishment [37].

Jeannerod et al. implemented verbal information because current motor cognition theories, which suggest that language resonates with motor representations and activation of motor areas, can therefore be achieved through verbal route [38].

Mental Practice itself functions as feedback and exerts a direct effect on the central nervous system. Because imagery and movement have been shown to be functionally equivalent, mental images like those used in MP could help in the process of engram formation. This image would then create a perception of motor performance that would activate the "automatic monitoring centre" and facilitate the consolidation of engram programming [39].

In our opinion MP could be used to augment the frequency of repetition of movement at a cerebral level, with no increase in the physical demand for the patient. It could also be useful in maintaining the results achieved.

Limitations

In this study we have not used more effective quantitative measurements such as ARAT for evaluation. Sample size was small, so the result cannot be generalized. Intensity and level of auditory imagery must be matched with patient's mental status and Comprehension.

We have used MMSE for screening function only there is need to use an instrument to find out how much improvement occurred in cognitive domain, this could be another limitation of this study.

Future Research

Future clinical trial study can be carried out on a larger sample size with long term follow up. A similar study can be conducted including acute, sub-acute and chronic (in 3 different groups) stroke patients.

In this study, selected task oriented activities has been given to patients, further study has to be done with types of task oriented training.

Clinical Implication

The results of this study have important clinical implication for developing effective intervention for patients with stroke by incorporating mental practice for upper extremity muscles that can improve the motor functions for activities of daily living.

As auditory imagery practices do not require sophisticated equipments so they can be easily incorporated in any rehabilitation technique.

Conclusion

This study concludes that mental practice with physical practice is more effective than physical practice alone, thereby providing evidence that it is a better strategy to include mental practice in combination with physical practice in stroke rehabilitation.

References

1. (1989) Stroke. Recommendations on stroke prevention, diagnosis, and therapy. Report of the WHO Task Force on Stroke and other Cerebrovascular Disorders. Stroke 20: 1407-1431.
2. Aho K, Harmsen P, Hatano S, Marquardsen J, Smirnov VE, et al. (1980) Cerebrovascular disease in the community: results of a WHO collaborative study. Bull World Health Organ 58: 113-130.
3. World Health Organization. WHO Burden of Diseases and Injury (Dataset-2002).
4. Razdan S, Koul RL, Motta A, Kaul S (1989) Cerebrovascular disease in rural Kashmir, India. Stroke 20: 1691-1693.
5. Anand K, Chowdhury D, Singh KB, Pandav CS, Kapoor SK (2001) Estimation of mortality and morbidity due to strokes in India. Neuroepidemiology 20: 208-211.
6. Workshop report on Stroke surveillance in India coordinated and report prepared by Dr. Bela Shah senior deputy director general & chief Dr. Prashant Mathur assistant director general division of Noncommunicable diseases Indian council of Medical Research Ansari nagar, New Delhi-110029 INDIA Supported by The World Health Organization New Delhi.
7. Ay H, Furie KL, Singhal A, Smith WS, Sorensen AG, et al. (2005) An evidence-based causative classification system for acute ischemic stroke. Ann Neurol 58: 688-697.
8. Labovitz DL, Sacco RL (2001) Intracerebral hemorrhage: update. Curr Opin Neurol 14: 103-108.
9. Collin C, Wade D (1990) Assessing motor impairment after stroke: a pilot reliability study. J Neurol Neurosurg Psychiatry 53: 576-579.
10. Taub E (1980) somatosensory deafferentation research with monkeys: implications for rehabilitation medicine. Inc; Ince LP, ed behavioural psychology in rehabilitation medicine: clinical applications. Baltimore,Williams and Wilkins.
11. Ernst E (1990) A review of stroke rehabilitation and physiotherapy. Stroke 21: 1081-1085.
12. Carr JH, Shephard RB (2002) Guidelines for Exercise and Training to optimize Motor Skill. Stroke Rehabilitation 26:987-991.
13. Richardson (1994) Does Mental Practice Enhance Performance? Journal of Applied Psychology 79: 481-492.
14. Jeanine A Verbunt (2008) mental practice-based rehabilitation training to improve arm function and daily activity performance in stroke patients: a randomized clinical trial. BMC Neurology 8: 1-10.

15. Weinberg R, Jackson A (1985) Mental Imagery and its potential for Physiotherapy. Journal of American Physical therapy Association 68: 516-521.
16. Sanford J, Moreland J, Swanson LR, Stratford PW, Gowland C (1993) Reliability of the Fugl-Meyer assessment for testing motor performance in patients following stroke. Phys Ther 73: 447-454.
17. Platz T, Pinkowski C, van Wijck F, Kim IH, di Bella P, et al. (2005) Reliability and validity of arm function assessment with standardized guidelines for the Fugl-Meyer Test, Action Research Arm Test and Box and Block Test: a multicentre study. Clin Rehabil 19: 404-411.
18. Pandyan AD, Johnson GR, Price CI, Curless RH, Barnes MP, et al. (1999) A review of the properties and limitations of the Ashworth and modified Ashworth Scales as measures of spasticity. Clin Rehabil 13: 373-383.
19. Gregson JM, Leathley M, Moore AP, Sharma AK, Smith TL, et al. (1999) Reliability of the Tone Assessment Scale and the modified Ashworth scale as clinical tools for assessing poststroke spasticity. Arch Phys Med Rehabil 80: 1013-1016.
20. Folstein MF, Folstein SE, McHugh PR (1975) 'Mini-mental State' A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 12: 189-198.
21. Roth M, Tym E, Mountjoy CQ, Huppert FA, Hendrie H, et al. (1986) CAMDEX. A standardised instrument for the diagnosis of mental disorder in the elderly with special reference to the early detection of dementia. Br J Psychiatry 149: 698-709.
22. Timmermans AA, Spooren AI, Kingma H, Seelen HA (2010) Influence of task-oriented training content on skilled arm-hand performance in stroke: a systematic review. Neurorehabil Neural Repair 24: 858-870.
23. Pang MY, Harris JE, Eng JJ (2006) A community-based upper-extremity group exercise program improves motor function and performance of functional activities in chronic stroke: a randomized controlled trial. Arch Phys Med Rehabil 87: 1-9.
24. Page SJ, Levine P, Sisto SA, Johnston MV (2001) Mental practice combined with physical practice for upper-limb motor deficit in subacute stroke. Phys Ther 81: 1455-1462.
25. Page SJ (2000) Imagery improves motor function in chronic stroke patients with hemiplegia: a pilot study. Occup Ther J Res 20:200–215.
26. Linden CA, Uhley JE, Smith D (1989) the effects of mental practice on walking balance in an elderly population. Occup Ther J Res 9: 155-169.
27. Fairweather MM, Sidaway B (1993) Ideokinetic imagery as a postural development technique. Res Q Exerc Sport 64: 385-392.
28. Magill R (1998) Motor Learning (5thedn) WCB/McGraw-Hill, Boston
29. Page SJ, Levine P, Leonard AC (2005) Effects of mental practice on affected limb use and function in chronic stroke. Arch Phys Med Rehabil 86: 399-402.
30. Szaflarski JP, Page SJ, Kissela BM, Lee JH, Levine P, et al. (2006) Cortical reorganization following modified constraint-induced movement therapy: a study of 4 patients with chronic stroke. Arch Phys Med Rehabil 87: 1052-1058.
31. Lafleur MF, Jackson PL, Malouin F, Richards CL, Evans AC, et al. (2002) Motor learning produces parallel dynamic functional changes during the execution and imagination of sequential foot movements. Neuroimage 16: 142-157.
32. Bakker FC, Boschker M, Chung J (1996) Changes in muscular activity while imagining weightlifting using stimulus or response propositions. J Sport Exerc Psych18: 313-324.
33. Livesay JR, Samaras MR (1998) Covert neuromuscular activity of the dominant forearm during visualization of a motor task. Percept Mot Skills 86: 371-374.
34. Roth M, Decety J, Raybaudi M, Massarelli R, Delon-Martin C, et al. (1996) Possible involvement of primary motor cortex in mentally simulated movement: a functional magnetic resonance imaging study. Neuroreport 7: 1280-1284.
35. Weiss T, Hansen E, Beyer L, Conradi ML, Merten F, et al. (1994) Activation processes during mental practice in stroke patients. Int J Psychophysiol 17: 91-100.
36. Ito M (1993) Movement and thought: identical control mechanisms by the cerebellum. Trends Neurosci 16: 448-450.
37. Kopelman RE (1982) Improving productivity through objective feedback: A review of the evidence. National Productivity Review 2: 43–55.
38. Jeannerod M (2001) Neural simulation of action: a unifying mechanism for motor cognition. Neuroimage 14: S103-109.
39. Kottke FJ, Halpern D, Easton JK, Ozel AT, Burrill CA (1978) the training of coordination. Arch Phys Med Rehabil 59: 567-572.