Research Article

Available Online at: www.ijpir.com

International Journal of Pharmacy and Industrial Research

ISSN	Print	2231 – 3648
	Online	2231 – 3656

BILATERAL UPPER EXTREMITY TASK SPECIFIC TRAINING (TST) AND BOBATH NEURO DEVELOPMENTAL THERAPY (NDT) IN FUNCTIONAL RECOVERY OF STROKE

[*1]Ramachadran Arunachalam, [2]Janakiraman Balamurugan

[*1]SriChandrasekarendra Saraswathi VishwaMahaVidyalaya University,
Enathur, Kanchipuram, Tamil Nadu, India – 631561.

[2]School of Medicine, Dept of Physiotherapy, University of Gondar, Ethiopia.

Abstract

Traditionally, stroke rehabilitation had been focused on passive approaches or compensating the non paretic hand. Recently both the paradigms for rehabilitation interventions and time frame for possible upper extremity motor recovery have been challenged.Recent reviews of motor rehabilitation and neural reorganisation have indicated that intervention strategies based on sound motor control and learning principles offer considerable promise in promoting recovery in chronic stroke patients. This study is of experimental study design. Outcome measures are Action Research Arm Test (ARAT) and Wolf Motor Function Test (WMFT).A total of thirty subjects who met with the criteria were randomized into bilateral task specific and neuro developmental therapy groups, fifteen each. The individuals of both groups were trained for 40 minutes per session by qualified therapists for 4 days in a week for 6 weeks. Functional ability of impaired upper extremity were measured prior to and following treatment protocol using ARAT and WMFT. Individuals those who received bilateral task specific training showed a reduction in movement time (WMFT) of the impaired limb and increased upper extremity functional ability (ARAT) compared to individuals receiving neuro developmental therapy. Overall, these findings suggest that bilateral task specific training protocol improves motor function in patients with much denser upper extremity hemi paresis than Bobath [NDT] training and the gains can be attained over a relatively brief training period.

Keywords: ARAT, WMFT, NDT, TST.

Introduction

Stroke is a medical emergency and can cause permanent neurological damage, complications, and death. It is the leading cause of adult disability and the second leading cause of death worldwide. The definition of stroke originates with the World Health Organization (WHO) and dates back to 1980, which states that “Rapidly developing clinical signs of focal (at times global) disturbance of cerebral function, lasting more than 24 hours or leading to death with no apparent cause other than that of vascular origin”.

Several population-based surveys on stroke were conducted from different parts of Asia. Stroke

Author for Correspondence:
Ramachadran Arunachalam,
SriChandrasekarendra Saraswathi VishwaMahaVidyalaya University,
Enathur, Kanchipuram, Tamil Nadu, India – 631561.
E-mail: arunstar19@gmail.com

affects 15 million people in the world each year and approximately one-third will live with the sequel of this disease. Asians have higher prevalence of stroke. Stroke is one of the 10 highest contributors of medicare costs and among elderly, stroke and transient ischemic attacks are leading causes of hospitalization[1].Hypertension is the most important risk factor. Stroke represented 1.2% of total deaths in India. Of all deaths in industrialized countries 10–12 per cent is due to stroke, and about 88 per cent of the deaths attributed to stroke are amongst people over 65 years of age[2].

Although stroke can cause deficits in number of neurological domains, the most commonly affected is motor system. Impaired upper extremity function is a common and often devastating problem for stroke survivors[3]. Stroke risk is higher in men than in women, more women die secondary to stroke due to their greater life expectancy. Moreover, given the central role that hand dexterity play a vital role in human existence and the functional independence of a human is reflected by degree of hand function much attention in rehabilitation and research has been focused on hand motor function after stroke.

Traditionally, stroke rehabilitation had been focused on passive approaches or compensating the non paretic hand. Recently both the paradigms for rehabilitation interventions and time frame for possible upper extremity motor recovery have been challenged.Recent reviews of motor rehabilitation and neural reorganisation have indicated that intervention strategies based on sound motor control and learning principles offer considerable promise in promoting recovery in chronic stroke patients[4, 5]. In particular, encouraging use of the hemiplegic limb through activity dependent interventions has evidenced some success in expediting progress toward recovery of upper limb function[6, 7]. However, Contextual interference has not been empirically investigated in upper extremity stroke rehabilitation,this study uses active practise of context-specific motor tasks of upper extremity and feedback to regain the lost motor functionsin the form of bilateral task specific training (TST) protocol and Bobath (NDT) protocol and comparing the outcome measures and analyzing the effectiveness.

Method

Participants

Thirty individuals with hemiplegia due to stroke were randomly assigned to either a bilateral upper limb task specific training (9 males, 6 females, involved side right 7, left 8, age 55.7 ± 14 years (mean ± SD)) or Neuro developmental therapy (10 males, 5 females, involved side right 10, left 5 age 58 ± 16years [mean±SD]). Participants were Chennai community dwellers seeking treatment in various neurological rehabilitation centers. Criteria for inclusion in study: first stroke at least 6 months prior to the training; no multiple infarction; medically stable and intact cognitive functions; Minimal anti gravity movement in shoulder of paretic arm; thrombotic and hemorrhagic stroke; no other neurological disorders. Subjects read and signed an institutional review board/ethics committee approved informed consent before being tested.

Outcome measures

The functional motor ability of the paretic upper limb was assessed by Action Research Arm Test (ARAT) and Wolf Motor Function Test (WMFT) prior to and following the training period. The ARAT's is a 19 item measure divided into 4 sub-tests (grasp, grip, pinch, and gross arm movement). Performance on each item is rated on a 4-point ordinal scale ranging from 0 to 3. Maximum score on the first (most difficult) item are credited with having scored 3 on all subsequent items on that scale. If the patient scores less than 3 on the first item, the second item is assessed. This is the easiest item, and if patients score 0 then they are unlikely to achieve a score above 0 for the remainder of the items and are credited with a zero for the other items[8]. The maximum score on the ARATS is 57 points (possible range 0 to 57). Wolf Motor Function Test (WMFT) is scale of timed tasks, performed as quickly as possible and truncated at120 seconds[9-11]. The possible score range of WMFT is 0 to 75.

Intervention protocol

Baseline assessment, ARAT and WFMT scores were undertaken on the day prior to initiation of the training protocols. The participants of both groups were trained for 40 minutes per session by qualified therapists for 4 days in a week for 6 weeks. Participants were seated in a comfortable chair in front of a table with adjustable shelf to enable individual based adjustment allowing easy reach to target area. Bilateral task specific training group participants performed eight level tasks with both impaired and unimpaired hand and Neuro-developmental therapy group were also trained with NDT specific tasks for the impaired hand. Over the next six weeks the participants completed a series of training sessions and a set of investigators blinded to the assignment of participants training condition collected post test scores.

Bilateral task specific training program tasks

1. Opening/pulling a drawer with one hand, while the other hand picks the peg out.
2. Unscrewing the cap and placing it on the table.
3. Picking up a glass and pouring water from the bottle into a glass.
4. First, place impaired hand on the object, and then place their unimpaired hand over their involved hand to help them "hold" it during the task.
5. Holding paper with affected hand and cutting the paper with the unaffected hand.
6. Folding the towel with the use of both hands.
7. Holding the lock in one hand and turning the key.
8. Lifting the basket with both the hands.

Statistical analyzes and Results

The data were analyzed with SPSS 20 descriptively and paired 't' test were used to analyze the pre test score and post test score of ARAT and WMFT of bilateral task specific training group and NDT group. The groups were not significantly different in age, gender, side of stroke, type of lesion, or cognitive impairments at baseline. The ARAT pre test mean of bilateral task specific training group is 23.33(SD±3.43) and for NDT group 21.60 (SD±2.94), WMFT pre test mean of bilateral task specific training group 57.81(SD±2.167), NDT group mean 56.60 (SD±2.58) shows pre test similarity. The observed mean 23.33 of **ARAT** for bilateral task specific training before the interventions was decreased to the mean of 31.60 **(**SD±3.924) after the intervention. The observed mean 57.81of time based **WMFT** for bilateral task specific training before the interventions also showed improvement after training with mean 47.47 (SD±2.696). The observed mean 21.60 (SD±2.947) of ARAT for Bobath [NDT] training before the interventions is decreased to the mean of 24.93 (SD±3.82) and WMFT for NDT group the observed mean was 56.60 in pre test and showed little improvement in post test mean 51.13 (SD±2.031). The ARAT scores between groups showed significant improvement, WMFT scores for timed performance proves to be much more significant. Thus bilateral task specific training group shows better functional changes.

Discussion

In this experimental study, for 6 weeks of bilateral task specific training with Bobath [NDT] training; we found that bilateral task specific training improved furthermore key measure of sensorimotor impairments, functional ability (performance time), and functional use in patients with upper extremity stroke than Bobath [NDT] training and these improvements were maintained at 2 months after patients stopped training, suggesting that the motor improvements were potentially durable. This supports the hypothesis that bilateral task specific training improves motor function in stroke patients than Bobath [NDT] training program.

Practicing bilateral movements in synchrony (and in alternation) may result in a facilitation effect from the non paretic arm to therapeutic arm. Bilateral task specific training are initiated simultaneously, the arms act as a unit that supersedes individual arm action, indicating that both arms are strongly linked as a coordinated unit in the brain. Furthermore, studies have shown that learning a novel motor skill with one arm will result in a subsequent bilateral transferor skill to the other arm. Taken together, these experiments suggest a strong neurophysiologic linkage in the central nervous system that explains how bilateral (simultaneous and perhaps alternating) movements may benefit motor learning[12].

An important aspect of the bilateral task specific training is repetition, or "time on task," is a well-known motor learning principle, and recent animal studies have demonstrated that repetitive motor task rather than forced use alone may best promote central neural plasticity. One recent study demonstrated the efficacy of having a real object (goal) to reach for in patients with hemi paretic arms. Collectively, it is plausible that the techniques employed that involved repetition and task oriented, based as they are on motor learning principles in non hemiparetic persons, and may also contribute to motor relearning in the hemiparetic case. Our initial findings suggest that even patients with quite severe upper extremity hemiparesis can benefit from bilateral task specific training than Bobath [NDT] training[13].

Our results suggest that the bilateral task specific training protocol improves motor function in patients with much denser upper extremity hemi paresis than Bobath [NDT] training. This expands the applicability of task-oriented training across a broader deficit severity spectrum in stroke. The most important finding is our training protocol demonstrates that gains can be attained over a relatively brief training period. Regardless, the present study demonstrates that functional gains in a paretic arm can be achieved after a total of only 6 weeks of training; it is possible that longer training periods, could result in greater motor and functional gains. changes that occur quickly after practice more likely represent an "unmasking" of dormant neuromuscular pathways rather than neural reorganization or plasticity. The veracity of this argument requires direct investigation of underlying mechanisms. In addition, reconditioning of the neuromuscular system by reversing disuse atrophy may contribute to functional gain.

Conclusion

From, this study it is concluded that Bilateral task specific training regimen based on motor learning principles leads to significant and potentially durable functional gains in the paretic upper extremity of stroke subjects compared with Bobath [NDT] training group. While bilateral movements may also help recruit secondary motor areas in both hemispheres, recovery promoted by these areas will be less than that obtained through direct cortico-spinal projections. There is clearly a need to examine cortical plasticity associated with bilateral therapy in a larger group of chronic stroke patients and to determine the type of patient, in terms of side and site of lesion, who might benefit most from bilateral training.

Acknowledgement

Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors/ editors/ publishers of all those article, journals and books from where the literature for this article has been reviewed and discussed.

Fig No. 01

Fig. No. 02

Ramachadran Arunachalam. et al., Int. J. Pharm & Ind. Res., Vol.–03 (04) 2013 [301 - 305]

Table No. 01: Comparison of pre test and post test score of Action Research Arm Test (ARAT) and Wolf Motor Function Test (WMFT) within bilateral task specific training group

Bilateral task specific training group	PRE TEST		POST TEST		t value	p value
	Mean	SD	Mean	SD		
ARAT	23.33	3.436	31.60	3.924	4.620	0.000
WMFT	57.87	2.167	47.47	2.696	15.617	0.000

Table No. 02: Comparison of pre test and post test score of Action Research Arm Test (ARAT) and Wolf Motor Function Test (WFMT) within Bobath [NDT]

Bobath [NDT]	PRE TEST		POST TEST		t value	p value
	Mean	SD	Mean	SD		
ARAT	21.60	2.947	24.93	3.82	4.620	0.000
WMFT	56.60	2.586	51.13	2.031	15.617	0.000

Table No. 03: Comparison of pre test and post test scores of Action Research Arm Test (ARAT) and Wolf Motor Function Test (WMFT) between bilateral task specific training group &Bobath [NDT] training group.

Group	Dependant variables	Pre test	Post test	95%CI	't' test
		Mean (SD)	Mean (SD)		
BTST group	ARAT	23.33(3.496)	31.60(3.92)		
	WMFT	57.87(2.167)	47.47(2.69)	3.747 –9.586	4.678
NDT group	ARAT	21.60(2.947)	24.93(3.82)	5.452–1.882	4.208
	WMFT	56.60(2.586)	51.13(2.03)		

BTST - Bilateral task specific training, NDT - Neuro Developmental Therapy, SD - Std Deviation

References

1. Shyamal K. Das, Tapes K. Banrejee. Epidemiology of stroke in India. Neurology Asia 2006; 11:1-4.
2. Judith h. Lichtman, EricaCLeifheit- Limson, Sara B, ones Michael, S. Phipps,L.B. Goldstein. Predictors of hospital readmissions after stroke 2010; 41: 2525-2533.
3. Nakayama H, Jorgensen HS, Raaschou HO, Olsen TS. Recovery of upper extremity function in stroke patients: the Copenhagen Stroke Study. Arch Phys Med Rehabil 1994; 75:394-398.
4. Cauraugh JH, Summers JJ. Neural plasticity and bilateral movements: a rehabilitation approach for chronic stroke. ProgNeurobiol 2005; 75: 309–20.
5. Winstein CJ, Wing AM, Whitall J. Motor control and learning principles for rehabilitation for rehabilitation of upper limb movements after brain injury. In: Boller F, Grafman J, Robertson IH, editors. Handbook of neuropsychology. The Netherlands: North Holland; 2003. p. 77–137
6. Cohen LG, Hallett M. Neural plasticity and recovery of function. In: Greenwood RJ, Barnes MP, McMillan TM, Ward CD, editors. Handbook of neurological rehabilitation. 2nd ed. Hove, UK: Psychology Press; 2003. p. 99–111.
7. Fisher BE, Sullivan KJ. Activity-dependent factors affecting post stroke functional outcomes. Top Stroke Rehabil 2001;8: 31–44.
8. Lyle, R. C. (1981). "A performance test for assessment of upper limb functions in physical rehabilitation treatment and research." Int J Rehabil Res 4(7333761).
9. Wolf, S.L, Catlin, P.A.,et al (2001). Assessing wolf motor function test as outcome measure for research in patients after stroke. Stroke 32:1635-1639.
10. Fritz, S.L., Blanton, S, et al (2009) Minimal detectable change scores for the Wolf motor function test. Neurorehabil Neural Repair 23:662-667.
11. Morris. D.M.,Uswatte, G., et al . (2001) the reliability of wolf motor function test for assessing upper extremity function after stroke Arch Phys Med Rehabil 82:750-755.
12. Ward NS, Newton JM, Swayne OBC, Lee L, Thompson AJ,Greenwood RJ, et al. Motor system activation after subcortical strokedepends on corticospinal system integrity. Brain 2006; 129:809–19.
13. Ward NS. Functional reorganization of the cerebral motor system afterstroke. CurrOpinNeurol 2004; 17:725–30.