

Comparison of Task Specific Training Vs Neuro Developmental Training Approach Along with Conventional Therapy for Upper Limb Motor Function Among Chronic Stroke Patients

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Abstract

Objective: The purpose of this study is to compare Task Specific Training versus Neurodevelopmental Training approach along with conventional therapy for upper limb motor function among chronic stroke patients.

Study Design: Randomized Controlled Trial (RCT).

Place and Duration of study: This study took place in Lahore, Pakistan and the duration of the study was 6 months.

Method: This study is a Randomized Controlled Trial utilized a non-probability purposive sampling technique, the primary outcome measure was Modified Ashworth Scale (FMA) and Fugl-Meyer Assessment Scale (FMA) which were used to check the Spasticity and Motor Function. The findings were then statistically analysed by non parametric tests Mann Whitney U Test and Friedman Test were used for between group and within the group comparisons respectively.

Results: A total of 74 patients participated in the study among which after randomized allocation of 37(50%) in TST and 37(50%) in NDT group. TST group showed better results than the NDT group and the p value is 0.000 which is less than 0.05 when compared between the groups for spasticity at 12 weeks. TST group showed better results than the NDT group and the p value is 0.00 which is less than 0.05 when compared between the groups for functional ability at 12 weeks. Therefore, TST is better than NDT for the improvement of both spasticity and functional ability.

Conclusion: Both of the treatment approaches have proven to be effective in treatment of spasticity and motor functional ability among chronic stroke patients but Task Specific Treatment has proven to be significantly more effective than Neurodevelopmental Training and has more significant results.

Discussion: The current study which is Comparison of Task Specific Training versus Neurodevelopmental Training along with conventional therapy for upper limb motor function among chronic stroke patients shows that the Task Specific Training shows better results than Neurodevelopmental training in the motor recovery or functional ability of the upper limb similarly the study which was conducted in India in 2012 by Kamal Narayan et al. shows that the task specific training had significant more improvements in motor recovery of the upper limb of stroke patients. This study was conducted on 103 patients and the participants were assigned to the Task specific Training or to the Bo bath training for 4-5 days for 4 weeks. The Fugl- Meyer assessment, the Graded Wolf Motor Function Test were outcome measures [1].

Keywords: Task Specific Training (TST), Neurodevelopmental Training (NDT), Modified Ashworth Scale (MAS), Fugl- Meyer Assessment Scale (FMA).

Introduction

According to the WHO the stroke is defined as the clinical syndrome having the focal and global disturbance of brain function more than twenty four hours which leads to death having no specific non vascular cause [2]. Most post-stroke care rely on rehabilitation therapies [3]. Prevalence of stroke is increased in the elderly population [4]. Stroke is being the second leading cause of mortality and functional disability worldwide [5]. In Asia the stroke is the major cause of the disability and mortality rate [6]. The recovery period of the upper limb extremity is longer than the lower extremity [7]. About 87% of the all-stroke survivors have hand paralysis [8]. Thus the patients remain unable to perform activities of daily living (dressing, washing, eating, shopping etc) [9].

Different approaches are being used in the neurological rehabilitation of the stroke patients such as the Task Specific Training (TST), Neurodevelopmental Treatment (NDT), Proprioceptive Neuromuscular Facilitation (PNF), Motor Relearning Program (MRP), Rood's approach, Mirror Therapy, Cognitive Behavioral Therapy as well as infinite contemporary and modern physical therapy techniques. Hundreds and thousands of researches have been taking place for past one and a half century to compare and choose the better approach according to the client centered goals but there is still a high number of confusions that which approach is better for upper limb motor function [10].

Task-specific training is defined as training or therapy in which patients "perform context-specific motor tasks while receiving some sort of feedback." In rehabilitation, task-specific training focuses on goal-directed practise and repetition to enhance performance in functional tasks. The emphasis is on functional task training instead of impairment training, such as muscle strengthening. Different research studies show that the Task Specific Training should be incorporated in the physical rehabilitation program so at least they can do their basic tasks independently like eating, drinking, toileting and etc [11, 12]. Janet Carr and Roberta Shephart in the year 1987 tell us about the idea of Task Specific Training (TST) [12] It emphasizes on the relearning of task based on the specific movements related to activities [13]. Some studies shows that this approach is good but lack in evidence as it consists of small clinical trials and very less observational studies [14].

On the other hand, Neuro-Developmental Treatment is almost century old treatment therapy still considered as a standard care approach around the globe [15]. Neurodevelopmental focuses on

the encouragement of normal synergy pattern and resists the abnormal or compensatory pattern of movement [16]. This approach believes that the patient should be active while the therapist assists the patient to move in control and reflex inhibiting pattern. This approach is successfully applied on the any functional disability [17]. Although the Neurodevelopmental approach is widely used but there is scarcity of the evidence that is this approach is best for the upper limb motor function in stroke patients [18]. Bobath approach has been modified along the passing years and is currently named as Neurodevelopmental Treatment (NDT) [19].

There are several studies that show the use of the combination of different therapies is very effective in the physiotherapy rehabilitation but there is a lack of evidence that which combination of therapies is most effective among the humongous number of approaches available worldwide [20]. Especially there is no clear evidence that which approach is better for the upper limb motor function in chronic stroke patients from the approaches described above [21]. So, the purpose of this study is to compare the effects of Task Specific Training and Neurodevelopmental Treatment for upper limb motor function in chronic stroke patients.

Material and Methods

Study design

Study design was a Randomized Control Trial(RCT).

Study population

The study population was chronic stroke patients

Setting

As per permission of head of department of physiotherapy from superior university I was collecting data from:

- Chaudhary Muhammad Akram Teaching and Research Hospital.
- Shadman Medical Center.
- Services Hospital.

Duration of study

The duration of study was 6 months after the approval of synopsis.

Sampling technique

Non-probability purposive sampling technique was used in this study.

Sample size

The calculated sample size is the 34 in each group with the help of open epi tool as the outcome measure. After adding 10% dropout in the each group the sample size will be the 37 in each group so the total sample size of the study is 74(22)

Sample Size For Comparing Two Means

Input Data			
Confidence Interval (2-sided)	95%		
Power	80%		
Ratio of sample size (Group 2/Group 1)	1		
	Group 1	Group 2	Difference*
Mean	3.82	3.43	0.39
Standard deviation	0.44	0.67	
Variance	0.1936	0.4489	
<hr/>			
Sample size of Group 1	34		
Sample size of Group 2	34		
Total sample size	68		

*Difference between the means

Results from OpenEpi, Version 3, open source calculator--SSMean

$$n = \frac{2\sigma^2(z_{1-\alpha/2} + z_{1-\beta})^2}{(\mu_1 - \mu_2)^2}$$

$Z_{1-\alpha/2}$ Level of significance=95%

μ_1 Expected mean change in Motor Functioning in Group A=3.82(22)

μ_2 Expected mean change in Motor Functioning in Group B=3.43(22)

δ_1 Expected standard deviation in group A= 0.44(22)

δ_2 Expected standard deviation in group B=0.67(22)

$Z_{1-\beta}$ power of the study= 80%

n Expected sample size in a group=34(22)

After adding 10 % drop out in each group the sample size will be 37 in each group 37+37 equals to 74 so the total sample size of this study is 74

Eligibility criteria

Inclusion criteria

Following people was included in this study

- Chronic ischemic stroke patients(after 3 months of stroke).(23)
- Patients from both gender.(24)
- Patients of around age of 45-65.(25)
- Patient with limb spasticity equal to 2 or less than 2 on modified ash worth scale.(26)
- Patient with good cognitive function minimum 20 or more on Mini Mental State Examination (MMSE).(27)

Exclusion criteria

Following people was excluded from this study

- Patients with history of the recurrent stroke.(23)
- Patient with fracture or dislocation of upper limb.(28)
- Patient with any peripheral vascular disease (29)
- Patient with any comorbid neurological disease like Parkinsonism, epilepsy, multiple sclerosis and spinal cord injury.(21)

- Patient with skin discoloration, skin ulcers and skin allergy.(30)

Ethical Approval and Screening:

After giving the informed signed consent the all participants have the detailed neurological examination and assessed for the eligibility as defined in the inclusion and exclusion criteria. for assessing the eligibility criteria participants was undergo screening and examination. We also assess the patient's cognitive level by Mini Mental State Examination (MMSE). After the baseline assessment, the eligible participants was randomly assigned to <in 1:1 ration > both groups group A and group B group A was receive the routine physical therapy treatment with Task Specific Training protocol and group B was receive the routine physical therapy treatment with Neurodevelopmental protocol.

Randomization:

Computer generated Randomization assignments was designed by an independent statistician and randomization was done by one of the research team members who will not involve in patient recruitment or assessment or data analysis. Randomization Assignments was kept in opaque, sealed envelope and unsealed by researcher after baseline testing. outcome assessors was unaware of group assignment.

Blinding:

Patient information was state that the study purpose is to determine the effect of Task Specific Training in addition to the routine physical therapy in comparison to Neurodevelopmental therapy and spasticity in patients without specifying the details of both programs except for similarities across the both groups. Both programs was personalized to the patient's abilities to ensure all eligi-

ble patients could complete the program. Researchers who assess the outcome and do data analysis was masked to group allocation. Patient was instructed not to talk about the content of their exercise program during the post intervention visit and could contact their therapist in case of any problem during trail participation.

Intervention:

Group A

Group A was given Task Specific protocol with routine physical therapy treatment for 45 mins on the upper limb for 3 days a week for a period of 12 weeks.

This Task Specific protocol was include different exercises like, do the polishing of the table top , can perform arm cradling, can supinate and pronate the cylindrical object with arm , while pushing the cylindrical object can extend the wrist , can reach forward to touch or to pick an object , can bend side ways to pick the object and place it on the table in front,etc [21].

Group B

Group B was given the Neurodevelopmental protocol with the

routine physical therapy for 45 mins on the upper limb 3 times a week for period of 12 weeks. The intervention was performed by the trained physical therapist.

This Neurodevelopmental protocol was include different exercises like , patient should sit while bearing weight , patient can do self-overhead movements with hand clasped , while holding the gymnastic ball reach forward and overhead position while sitting , weight bearing while plantigrade or quadruped position , while sitting or standing can move the ball in forward , backward and sideways [21].

Results:

Normality of Data

A total of 74 patients participated in the study among which after randomized allocation of 37(50%) in TST and 37(50%) in NDT group. The data shows that the Kolmogorov Smirnov Significance in all 3 values of TST and NDT groups are 0.000 which is less than 0.05 suggesting that the data is not normal hence the Man whitney and Fried Mann tests will be used. Table 5

Table 1: Tests of Normality

SPASTICITY	Group	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
	TST GROUP	.365	37	.000	.708	37	.000
NDT GROUP	.288	37	.000	.776	37	.000	
a. Lilliefors Significance Correction							

Comparison Between the groups for spasticity

A total of 74 patients participated in the study among which after randomized allocation of 37(50%) in TST and 37(50%) in NDT group. The data shows that there is very minimal mean value difference between the two groups and the p value is 0.755 which is more than 0.05 that is non-significant.

After 6 and 12 weeks the data showed that there is a mean value difference between the two groups i.e. TST group showed better results than the NDT group but the p value is 0.000 which is less than 0.05 hence it is highly significant. Hence we are rejecting the Null Hypothesis and accepting the Alternating Hypothesis.

Table 2

GROUPS		N	Mean Rank	Sum of Ranks
Spasticity Before	TST GROUP	37	38.19	1413.00
	NDT GROUP	37	36.81	1362.00
	Total	74		
Spasticity 6week	TST GROUP	37	28.39	1050.50
	NDT GROUP	37	46.61	1724.50
	Total	74		
Spasticity After 12 weeks	TST GROUP	37	27.58	1020.50
	NDT GROUP	37	47.42	1754.50
	Total	74		
TEST OF SIGNIFICANCE				
Mann-Whitney U			659.000	
Wilcoxon W			1362.000	
Z			-.313	
Asymp. Sig. (2-tailed)			.755	

Spasticity after 6 weeks	
Mann-Whitney U	347.500
Wilcoxon W	1050.500
Z	-3.821
Asymp. Sig. (2-tailed)	.000
Spasticity After 12 weeks	
Mann-Whitney U	317.500
Wilcoxon W	1020.500
Z	-4.192
Asymp. Sig. (2-tailed)	.000

Comparison Between the groups for Functional ability

A total of 74 patients participated in the study among which after randomized allocation of 37(50%) in TST and 37(50%) in NDT group. The data shows that there is a minimal mean value difference between the two groups and the p value is 0.523 which is more than 0.05 hence it is non-significant.

After 6 weeks the data showed that there is a difference in mean

value between the two groups i.e. TST group showed better results than the NDT group but the p value is 0.002 which is less than 0.05 hence it is significant.

After 12 weeks the data showed that the p value is 0.00 which is less than 0.05 hence it is highly significant. Hence we are rejecting the Null hypothesis and accepting the Alternating Hypothesis

Table 3

Group		N	Mean Rank	Sum of Ranks
FMA CutOff Base Line	TST GROUP	37	36.00	1332.00
	NDT GROUP	37	39.00	1443.00
	Total	74		
FMA CutOff. 6weeks	TST GROUP	37	44.78	1657.00
	NDT GROUP	37	30.22	1118.00
	Total	74		
FGA.CutOff.12weeks	TST GROUP	37	49.68	1838.00
	NDT GROUP	37	25.32	937.00
	Total	74		
TEST OF SIGNIFICANCE				
Spasticity Before				
Mann-Whitney U		629.000		
Wilcoxon W		1332.000		
Z		-.639		
Asymp. Sig. (2-tailed)		.523		
Spasticity after 6 weeks				
Mann-Whitney U		415.000		
Wilcoxon W		1118.000		
Z		-3.133		
Asymp. Sig. (2-tailed)		.002		
Spasticity After 12 weeks				
Mann-Whitney U		234.000		
Wilcoxon W		937.000		
Z		-5.264		
Asymp. Sig. (2-tailed)		.000		

Interval based comparison of spasticity

The Chi Square for TST group X2 (df=2, N = 37) = . 66.333, p< 0.05 while the Chi Square for NDT group X2 (df=2, N = 37) =. 32.370, p< 0.05 shows that significant differences exist in the spasticity improvement across all three assessment intervals. The result shows that there is a significantly huge improvement in spasticity in the TST as compared to NDT group after 6 weeks of intervention and further improvement after 12 weeks interval.

Interval based comparison of functional ability

The Chi Square for TST group X2 (df=2, N = 37) =. 71.042, p< 0.05 while the Chi Square for NDT group X2 (df=2, N = 37) =. 62.976, p< 0.05 shows that significant differences exist in the mobility improvement across all three assessment intervals. The result shows that there is a significant improvement in functional ability in the TST group as compared to NDT group after 6 weeks of intervention and similar improvement after 12 weeks interval.

Table 4 a. Friedman Test

SPASTICITY		
TST GROUP	Spasticity Before	2.99
	Spasticity after 6 weeks	1.69
	Spasticity After 12 weeks	1.32
NDT GROUP	Spasticity Before	2.54
	Spasticity after 6 weeks	1.96
	Spasticity After 12 weeks	1.50
TEST OF SIGNIFICANCE		
TST GROUP	N	37
	Chi-Square	66.333
	df	2
	Asymp. Sig.	.000
NDT GROUP	N	37
	Chi-Square	32.370
	df	2
	Asymp. Sig.	.000
FUNCTIONAL ABILITY		
GROUPS	Mean Rank	
TST GROUP	FMA Cut Off Base Line	1.03
	FMA Cut Off 6weeks	2.03
	FMA Cut Off 12weeks	2.95
NDT GROUP	FMA Cut Off Base Line	1.24
	FMA Cut Off 6weeks	1.85
	FMA Cut Off 12weeks	2.91
TEST OF SIGNIFICANCE		
TST GROUP	N	37
	Chi-Square	71.042
	df	2
	Asymp. Sig.	.000

Discussion:

The current study which is Comparison of Task Specific Training versus Neurodevelopmental Training along with conventional therapy for upper limb motor function among chronic stroke patients shows that the Task Specific Training shows better results than Neurodevelopmental training in the motor recovery or functional ability of the upper limb similarly the study which was conducted in India in 2012 by Kamal Narayan et al. shows that the task specific training had significant more improvements in motor

recovery of the upper limb of stroke patients. This study was conducted on 103 patients and the participants were assigned to the Task specific Training or to the Bo bath training for 4-5 days for 4 weeks. The Fugl- Meyer assessment, the Graded Wolf Motor Function Test were outcome measures [1].

The current study shows that the Neurodevelopmental training is not more effective than Task Specific Training for the improvement in functional ability of the upper limb similarly, the study

conducted in 2019 by Maria .J Diaz also shows that the there is no evidence that the Bo bath training is superior to any other approach but this study also states that there is moderate evidence that other approaches like Constrained Induced Therapy is better then Bo bath for the functional mobility of the upper limb. This study is rated according to the PEDRO scale by the two independent researchers. This study was conducted to collect data weather the Bo bath is superior to the other techniques [31].

A pilot study (single group study) done by Emlia Mikolajewska in 2016 to access the feasibility of larger RCTs conducted to check the effect of bobath therapy in young post stroke patients . in 2 weeks of treatment 10 session of neurodevelopmental therapy were conducted. Favorable and significant changes were observed of muscle tone hand functions and activity of daily life. they concluded that NDT is a promising method of stroke rehabilitation whereby the current study under discussion The Comparison of Task Specific Training versus Neurodevelopmental Training along with conventional therapy for upper limb motor function among chronic stroke patients showed that task specific training is more effective in treating upper limb disabilities after stroke.

Limitation:

The research has been conducted on local population of eastern Asia. The socioeconomic status of different areas of the globe vary according to the environmental, social and personal statuses. These alterations in socioeconomic conditions effect the time of recovery of the underlying disease. The financial resources and time available top us as students were extremely limited due to which the study was conducted in Lahore, Pakistan but can be conducted in northern regions of Pakistan where the environmental factors are completely different.

Recommendation:

- It is recommended that if it is possible to conduct this study in large geographical area with huge population and with large amount of funding this study will be more beneficial.
- It is recommended that if probability sampling technique will used then precise results will be given

Conclusion:

As per the current study which compared the Effectiveness of Task Specific Training versus Neurodevelopmental Training in treatment of spasticity and functional ability of the upper limb among chronic stroke patients. Both of the treatment approaches have proven to be effective in the treatment of spasticity and functional ability of the upper limb among chronic stroke patients but the Task Specific Training have to be significantly more effective than Neurodevelopmental Training and has reduced spasticity and increase functional ability of upper limb more efficiently [22-31].

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