

Effect of Task Related Training versus Conventional Training on Walking Performances in Post Stroke Patients

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Abstract: ***Background:** Gait is a factor that affects majority of patients with stroke. Patients are able to walk independently but not efficiently. There are variations in events of gait cycle. Patient's lack Flexibility in their performances. Moreover walking abnormally increases energy expenditure, decreases Biomechanical efficiency, reduces self esteem and not good esthetically. There is no any specific technique that will bring Gait patterns back to normal. **Objectives:** 1. To find whether Task Related Training is better to improve Walking performances 2. To find whether Conventional Training is better to improve walking performances 3. To find Effects of Task Related Training and conventional training on walking performances. **Methods:** 30 subjects were included according to inclusion and exclusion criteria. Written consent was taken from each. They were splitted into two groups. Group A: Task Related Training (8m+4f) and Group B: Conventional training (7m+6f). 5 subjects were lost in follow up. Interventions were given for 4 weeks and changes in spatial (stride length, step length), temporal (cadence, speed) and two Minute walk test were noted. **Results:** The results showed statistically significant improvement in spatial and temporal variables in task related training group and speed was reversed in conventional training group. **Conclusion:** Study concluded that task related training was significantly effective in improving walking performances. Conventional training is effective in reversing the speed. However task related training can be useful in improving quality of gait including performances in society level.*

Keywords: Task related training, spatial and temporal variables, stride length, step length, cadence, two minute walk test

1. Introduction

Stroke is an acute onset of neurological dysfunction due to abnormality in the cerebral circulation with resultant signs and symptoms that correspond to involvement of focal areas of brain. Stroke can be defined as "Rapidly developed clinical signs of focal(or global) disturbances of cerebral function lasting more than 24 hours or leading to death, with no apparent cause other than vascular origin"¹.

Prevalence of stroke in India according to the information received by K Anand and colleagues (2001) was 203 per 100,000 populations above 20 years old amounting to a total of 1 million cases². Stroke is the third commonest cause of death according to the statistics.

It has been noted that, although majority of patients with stroke walk independently, they are not able to walk efficiently. Patients walk with altered spatiotemporal variables. They exhibit uneven stride length and shorter step length. Patients spend longer time in double support. They even walk with decreased velocity. Walking with decreased speed increases energy expenditure. Due to these patients lacks flexibility in performances. Increased environmental demands such as walking on uneven surfaces, walking on slopes, crossing the road, walking on busy streets leads to reduced movement capacity within final leads to depression.

Human gait is one of the basic components of independent functioning that is commonly affected in patients with stroke.^{3, 4} The gait deviations in persons with Hemiplegia have been described according to their biomechanical and kinesiological abnormalities and in terms of loss of centrally

programmed motor control mechanisms. Perry⁵ described the common problems as loss of controlled movement from heel strike to midstance and loss of normal combination of movement patterns at the end of stance. Our major contribution in rehabilitation lies in training the motor control based on an understanding of the kinetics and kinematics of normal movement, motor control processes and motor learning. The major objective is to enhance the individual's physical ability to Interact with the environment and work in the community.

2. Literature Review

Dean CM and Shepherd RB⁶ concluded in their study that task related training improved the ability to balance during seated reaching activities in patients with stroke. The experimental group was involved in training programme of practicing the reaching beyond arm's length for a period of 2 weeks. After training the group showed significant increase in maximum reaching distance in all directions along with increase in activation of affected leg muscles and increase in load through affected foot.

Chan D YL⁷ (2006) had done a study to find out efficacy of motor relearning Programme on patients with stroke. In his study he included 52 patients who received 2 hour session for six weeks. He concluded that motor relearning programme is effective in enhancing functional recovery when compared with the control group who received conventional therapy.

Sal Bach NM⁸ (2004) showed that task oriented practice performed at high intensities Improves walking distance and

speed in people with stroke when compared with Other Methods. He included 10 functional task for strengthening lower limbs and Enhance walking balance, speed and distance for six weeks. Outcome measures were meter walk test, 6 minute walk test, time up and go, Berg balance test. The mobility interventions showed gain in walking deficits.

3. Materials & Methodology

25 subjects with stroke, who were referred to physiotherapy department of Krishna hospital, Karad and willing to take treatment, were recruited for the study. The subjects were treated for 4 weeks. The subjects were screened and were put in either of two groups- group I and group II. Group I was treated with Task Related Training and Group II was treated with Conventional training. A written informed consent was taken from each participant. Ethical clearance was obtained from university's institutional review board. Inclusion criteria were (1) All Stroke cases (2) First ever Stroke with 3 months post stroke. (3) Hemiplegia due to the involvement of middle cerebral artery (4) Patients with both the Sexes and any side (5) Able to walk independently with or without assistance (6) Walking deficits regarding patterns of Gait (7) Understands the instructions. Exclusion criteria was (1) Subjects having any medical condition that affects his / her performance (2) Completely recovered case of Stroke in terms of walking abilities (3) Subjects with Transient Ischemic Attack.

Outcome Measures

Subjects who participated in the study were evaluated two times, pre-training and post training. The clinical assessment consisted of spatiotemporal variables – stride length, step length and speed, cadence respectively and two minute walk test. Evaluation for all outcome measures were undertaken on one single day and exercise program was commenced since same day.

4. Statistical Analysis

Statistical analysis for present study was done manually as well as using the statistics software INSTAT so as to verify the results obtained. Various statistical measures such as mean, standard deviation (SD) and paired and unpaired test of significance were utilized for this purpose. Probability values less than 0.05 were considered statistically significant and probability values less than 0.0001 were considered statistically extremely significant.

5. Results

The mean age of the participants in task related training group was 54.5 years and the mean age of participants in conventional training group was 53.15 years. There was no statistically significant difference between the mean age and standard deviation of the participants in both the groups.

There were 25 participants in the study out of which 12 were under group A (TRT) in which there were 8 males and 4 females. There were 13 participants in Group B (CT) out of which there were 7 males and 6 females.

Table 1: Baseline characteristics of participants

Variable	Group A (TRT)	Group B (CT)
Sex	M-8 & F-4	M-7 & F-6
Age (years)	54.5	53.15

On comparing the step length value between both the groups there was no statistically significant difference with $p=0.3331$. The pre-interventional values of step length were 27.83 ± 11.58 in Group I (TRT) and 24.04 ± 7.295 in Group II (CT) respectively, whereas post-interventional values of step length were 39.40 ± 13.38 in Group I (TRT) and 29.156 ± 11.06 in Group II respectively. Intra Group results showed statistically very significant difference in post-intervention values for TRT Group. ($p=0.005$).

Table 2: Comparison Of Step length (A-U) between both the groups

Step Length:	Group I (TRT)	Group II (CT)	P value
Pre	27.83 ± 11.58	24.04 ± 7.295	0.3331
Post	39.40 ± 13.38	29.156 ± 11.06	0.0475
t value	3.468	2.018	
P value	0.005	0.0666	

On comparing the step length (U-A) value between both the groups there was no statistically significant difference with $p=0.4808$. The pre-interventional values of step length were 37.23 ± 10.14 in Group I (TRT) and 39.35 ± 9.956 in Group II (CT) respectively, whereas post-interventional values of step length were 46.04 ± 7.5 in Group I (TRT) and 34.156 ± 6.847 in Group II respectively. Intra Group results showed statistically no significant difference in post-intervention values for both the Group. ($p=0.0730$, $p=0.9230$).

Table 3: Comparison Of Step length (U-A) between both the groups.

Step Length (U-A)	Group I (TRT)	Group II (CT)	P value
Pre	37.23 ± 10.14	39.35 ± 9.956	0.4808
Post	46.04 ± 7.5	34.156 ± 6.847	0.0270
t value	1.985	0.0987	
P value	0.0730	0.9230	

On comparing the stride length value between both the groups there was no statistically significant difference with $p=0.5453$. The pre-interventional values of stride length were 63.97 ± 17.65 in Group I (TRT) and 60.048 ± 14.27 in Group II (CT) respectively, whereas post-interventional values of stride length were 84.13 ± 25.8 in Group I (TRT) and 68.15 ± 15.86 in Group II respectively. Intra Group results showed statistically very significant difference in post-intervention values for Group I (TRT). ($p=0.0021$).

Table 4: Comparison Of Stride length (A) between both the groups

Stride Length (A)	Group I (TRT)	Group II (CT)	P value
Pre	63.97 ± 17.65	60.048 ± 14.27	0.5453
Post	84.13 ± 25.8	68.15 ± 15.86	0.0725
t value	3.990	2.171	
P value	0.0021	0.0507	

On comparing the stride length value between both the groups there was no statistically significant difference with $p=0.3925$ pre-interventionally. The pre-interventional values of stride length were 65.33 ± 16.82 in Group I (TRT) and

59.85±14.59 in Group II (CT) respectively, whereas post-interventional values of stride length were 83.91±28.25 in Group I (TRT) and 68.02±15.4 in Group II respectively. Intra Group results showed statistically significant difference in post-intervention values for Group I (TRT). ($p=0.0114$).

Table 5: Comparison Of Stride length (U) between both the groups

Stride Length (U)	Group I(TRT)	Group II(CT)	P value
Pre	65.33±16.82	59.85±14.59	0.3925
Post	83.91±28.25	68.02±15.4	0.0911
t value	3.032	1.963	
P value	0.0114	0.0732	

On comparing the speed value between both the groups there was no statistically significant difference with $p=0.1588$ pre-interventionally. The pre-interventional values of speed was 20.63±5.77 in Group I (TRT) and 24.78±8.15 in Group II (CT) respectively, whereas post-interventional values of speed was 16.68±4.9 in Group I (TRT) and 17.47±7.6 in Group II respectively. Intra Group results showed statistically extremely significant difference in post-intervention values for both the groups. ($p=0.0005$, $p<0.0001$).

Table 6: Comparison Of Speed between both the groups.

Speed	Group I(TRT)	Group II(CT)	P value
Pre	20.63±5.77	24.78±8.15	0.1588
Post	16.68±4.9	17.47±7.6	0.7634
t value	4.907	6.518	
P value	0.0005	<0.0001	

On comparing the cadence value between both the groups there was no statistically significant difference with $p=0.015$ pre-interventionally. The pre-interventional values of cadence was 87.83±8.077 in Group I (TRT) and 75.69±13.9 in Group II (CT) respectively, whereas post-interventional values of cadence was 95.91±8.512 in Group I (TRT) and 79.84±12.9 in Group II respectively. Intra Group results showed statistically extremely significant difference in post-intervention values for both the groups. ($p<0.0001$, $p=0.0032$).

Table 7: Comparison Of Stride length between both the groups

Cadence	Group I(TRT)	Group II(CT)	P value
Pre	87.83±8.077	75.69±13.9	0.015
Post	95.91±8.512	79.84±12.9	0.0014
t value	6.085	3.6711	
P value	<0.0001	0.0032	

On comparing the TMWT value between both the groups there was no statistically significant difference with $p=0.2413$ pre-interventionally. The pre-interventional values of TMWT were 62.01±20.19 in Group I (TRT) and 52.58±19.04 in Group II (CT) respectively, whereas post-interventional values of cadence was 74.15±23.23 in Group I (TRT) and 55.21±18.46 in Group II respectively. Intra Group results showed statistically extremely significant difference in post-intervention values for group I. ($p=0.0002$).

Table 8: Comparison Of TMWT between both the groups

TMWT	Group I(TRT)	Group II(CT)	P value
Pre	62.01±20.19	52.58±19.04	0.2413
Post	74.15±23.23	55.21±18.46	0.0332
t value	5.478	2.040	
P value	0.0002	0.0640	

6. Discussion

The study “Effect of task related training versus conventional training on walking performances in post Stroke patients” was conducted to compare the two treatments and find out the best which improves the walking performances. Gait in stroke becomes the major limiting factor for subject’s dependency. It increases the energy expenditure, reduces Biomechanical efficiency and effects self esteem.

This study shows significant difference in the pre and post treatment values in both the groups. Task related training group showed significant improvement in the outcome variables concluding that it improves the walking performances. This was confirmed using statistical analysis by using ‘Paired t- test’ for within group comparison and ‘Unpaired t-test’ for between the group comparisons. In the present study, we found that after intervention there was significant improvement in the outcome with Task Related Training. It is effective in improving walking performances.

In group I (TRT) Post training improvement in task related training can be supported by plasticity following brain lesion. Reorganization after brain lesion takes place as a result of structural and functional changes. Repetitive exercises and training in real life task following stroke may be a critical stimulus to the making of new more effective functional connections within remaining brain tissue. Training and practice using methods that facilitate motor releasing would be essential to the formation of new functional connections. Neural system is inherently flexible adaptive and responding according to many factors like patterns of use. (NUDO AND COLLEAGUES, 2001) suggested that the complex organization provides the foundation for functional plasticity in motor cortex. Study by Pascual Leone et al on cortical representation reflects changes associated with skill development that and provoked by active, repetitive, training and practice. So it can be because of specificity of training with respect to different environmental conditions as practiced in Task Related Training might had helped in post training improvement in spatial variables.⁹

Improvement in temporal variables in Group I (TRT) is because as patients achieved skill in walking, task was made more complex by increased stepping over objects, difference in heights of objects, walking without stopping. These complexities were useful in real life activities. This might be the explanation for post training improvement in temporal variables.

In Group II (CT) improvement in knee extensor strength after training accounts to improvement in the temporal variables. This is supported by the study of Perry & colleagues who found that combination of gait velocity and

knee extension control was highly predictive of mobility function in stroke.¹⁰

Improvement in two minute walk test is in the line improvement in temporal variables. However it has been noted that walking speed over 10 meter overestimated distance walked in 2 minute. Therefore both walking speed and endurance need to be measured and training during rehabilitation.

This suggests that – with interventions of Task Related Training, long term stroke subjects are able to improve walking performances. This suggests that to maximize potential stroke rehabilitation need to continue in long term rather than cease within 3 months post stroke.

There was significant improvement noted in task related training group in all, this suggests that task related training is effective in improving walking performances. This might be because of task specificity of motor relearning programme which helped in improving motor control of lower limb and motor learning in walking with respect to task

Task related training might have helped the patients to have better motor planning and motor relearning. It may cause the specific recruitment of the motor units specifically for the task. Also in task related training emphasis was given on practicing a specific motor task, the training of controlled muscle action and control over movement component of walking.

Task related training involved training of real life activities while conventional training involved simple repeated movements which were not having meaning to the patient. Conventional training incorporated open chain exercises. Most of the patients could not generate sufficient muscular force against gravity. For them training was carried out in gravity elimination position. Therefore there might be lack of transfer of training while walking. Also patients in conventional training demonstrated variable degree of tightness. For them stretching became mandatory rather than conventional training.

In task related training intersegmental coordination was taken into consideration which might had help to improvement in walking performances. On contrary in conventional training intersegmental coordination was not taken into consideration.

Task Related Training added specificity and variability to practice. Patients were given opportunity to practice in variety of contexts. Although skill performance may be initially delayed, it might have helped in improved retention of skill. Then acquired skill can be applied more easily to other novel environmental situations in real life activities. However constant practice carried out in conventional training might have narrow context and learner had only limited number of solutions.

In Task related training the whole task was broken down into discrete parts. Individual components were practiced separately and immediately followed by performance of at least part of the activity for which patient was preparing.

This might had helped to improve the complex task of walking. Whereas in conventional training exercises for all muscle groups were carried out and at the end practice of walking was carried out which might had not useful to do transfer of training in complex task of walking.

In Task related training programme was in serial order. In step 4 patients were asked to perform variation in walking. This practice order might have produced generalizability of skill and better retention.

This might be due to variable contextual interference and increased depth of cognitive processing.^{3-10, 11, 12.}

The key element might be the degree to which learner was actively involved in problem solving. In conventional training patients performed exercises in blocked order which was repeated practice of task in a predictable order. Although this practice order might have produced improved early acquisition of skills, retention and generalizability of skill might be less.

These all considerations can be supported by a statement by Kottke¹³ that if the practiced activity has been precise, the engram will be precise i.e. “Practice doesn’t make perfect” rather, when it comes to motor engrams “Perfect Practice make Perfect”.

This accounts to better improvement in Task Related Training as compared to Conventional Training. In summary, the study shows very significant difference in pre & post values. Task related training improves the walking performances in all the outcome measures. Conventional training improves the speed component in post stroke patients.

7. Conclusion

The present study shows that Task Related Training was significantly effective in improving walking performances. Conventional training is effective in reversing the speed in post stroke patients. However Task Related Training played a significant role in improving rest of the parameters when compared with Conventional Training.

8. Future Scope

There was modification in exercise as according to patient’s need. Level of exertion wasn’t measured. Future follow up of the patients were not taken. The patients were not homogeneous. There were small group of females in the study, so gender distribution was poor. Therefore, studies could be conducted with large sample size; so as to obtain generalized results. Further study can be done including all the spatiotemporal variables, more objective equipments can be used to measure it. Before doing further studies, efforts should be made to gain normal parameters for spatiotemporal variables and two minute walk test in Indian population.

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