

Original Research Article

Comparison of dual-task specific training & conventional physiotherapeutic interventions in ambulation of left hemiplegic stroke patients; a randomized control trial

Abstract

Background: Physiotherapeutic interventions help in the motor-relearning & functional recovery of the stroke patients with the motor impairments of upper & lower limbs. Among the various physiotherapeutic interventions dual task training has been proved significantly effective in the functional recovery of the stroke patients. The aim of this study is to compare the effectiveness of dual-task training (DTT) & conventional physical therapy in ambulation left-hemiplegic stroke patients.

Method: this RCT was conducted at the King hospital, Swat from March 2019 to August 2019 on chronic left-hemiplegic stroke patients. The patients recruited for the study on the basis of set inclusion criteria were randomized into 2 groups; the treatment group (TG) received DTT while the control group (CG) received conventional physical therapy. DTT menu intervened contained were; slowly walking forward, backward & sideways on a smooth non-slippery surface while holding 80gram sandbag in hand. The CG received conventional physiotherapy which were; mat activities, strengthening & stretching exercise & ambulation/gait training. Pre & post tests clinical data were collected & analyzed on SPSS 22 for spatial & temporal variables for CG & TG by using 10MWT & TUG (10-Meter walk test & Time up & Go test respectively) along with step length, cadence, cycle time & stride length.

Results: of the 32 patients, there were 16(50%) in each of the group that both had 18 male (56%) & 14 female (44%). Mean age recorded in CG was 58.20 ± 6.20 & in the TG 58.27 ± 6.12 years. Baseline clinical parameters among both groups were almost identical ($P > 0.05$). Post-test score showed improvement of gait variables (temporal & spatial), 10MWT-score, cadence, step-length, stride & cycle time in TG as compared to CG with $P < 0.05$).

Conclusion; Dual-task training & conventional physical therapy significantly improves functional ability of the left-hemiplegic patients on all gait temporal & spatial parameters.

Keywords; Stroke, dual task training, conventional physical therapy, gait & ambulation

Introduction; Stroke is the 3rd cause of death globally; from 1990-2007 age standardized year of life lost (YLL) increased by 12.9% (10.6-15.2) & from 2007-2017 by 12.1% , while the stroke incidence increased 5.29Million (5.22-5.40) to 6.17 Million (6.4-6.33) from 2007-2017¹ ,thus, it increased DALYs (disability adjusted life years) due to multifaceted morbidity & effects of longevity from 3.54 to 9.66% in the period 1990-2013 as reported GBD statistic(Global burden of the Diseases)². High income countries (HIC) recorded a 42% decrease in the stroke while on the other hand low & middle income countries (LMIC) showed 100% increase in the last 3-4 decades². The statistics records that there are around 62 million stroke survivors globally while 1/3rd among them are living with severe disabilities⁴. It has been estimated that more than 80% DALYs occurs in LMIC^{3,4}. In spite of the recent effective advancement made in the management of the stroke such as; thrombolytic & endovascular interventions stroke remains one of the most common cause of disability worldwide²⁻⁵. Post-stroke disability is still a major health burden⁶⁻⁹. There is variation in the rehabilitation programs provided to the stroke patients worldwide & the quality & content of the program depends mostly on the medical & financial resources^{8,9}.

Stroke post-acute- care is given usually in the inpatient rehab centers or in the patient home & sponsored by Medicare in the USA¹⁰. Medicare expenditure on stroke is 15% of all other health-related expenditure^{8,9}. The outcome measures & the effectiveness of stroke rehabilitation programs has been surveyed through different registries such as; EROS (European register of stroke) & CERISE (Collaborative evolution of rehabilitation in stroke across Europe), however, greater variations exist among the countries in the union in their stroke –specific rehabilitation programs⁹⁻¹⁴. In Asian Countries including Pakistan post-stroke rehabilitation is carried out in inpatient rehabilitation facilities for the period of 4-6 months after the patient discharge from the acute hospital. Optimal functional recovery are the goals of these centers for the stroke patients but due to the unstructured rehab

program, greater variations are usually found by studies^{15,16}. Physiotherapeutic interventions help in the motor-relearning & functional recovery of the stroke patients with the motor impairments of upper & lower limbs¹⁵⁻¹⁷. Among the various physiotherapeutic interventions dual task training has been proved significantly effective in the functional recovery of the stroke patients¹. The aim of this study is to compare the effectiveness of dual-task training (DTT) & conventional physical therapy in ambulation left-hemiplegic stroke patients. DTT involves performing dual task at the same time & its impact is examined on the gait parameters (spatial& temporal variables)¹. It has been reported that DTT improves step-stride length & walking speed of the stroke patients^{16,18,19}. It has been reported that DTT along with the conventional physical therapy such as; mat activities, strengthening & stretching exercise, balance training & gait training in the chronic stroke patients is statistically effective in improving the ambulatory capacity of the stroke patients²⁰⁻²².

Methodology; the RCT was conducted at the King hospital, Swat from March 2019 to August 2019 on chronic left-hemiplegic stroke patients. The ethical approval & the consent was taken from the hospital admin & study's participants respectively. The sample size was calculated^{23,24} to achieve 80% power & Alpha value 95%. Based on the convenience sampling male & female left hemiplegic stroke patients, aged 40-64 years, medically stable & willing to participate in the study were included in the study. Left-hemiplegic patients with other complications such as bed ulcers or contractures, patients with cognitive impairments, speech & language impairments, patients with orthopedic lower limbs problems such as fractures, TIA patients & right hemiplegic patients were excluded. The patients recruited for the study on the basis of set inclusion criteria were randomized (lottery method) into 2 groups; the treatment group (TG) received DTT while the control group (CG) received conventional physical therapy. TG was exposed to DTT along with the stretching & strengthening exercise for 30 minutes 4 times/ week for 4 weeks. DTT menu intervened contained were; slowly walking forward, backward & sideways on a smooth non-slippery surface while holding 80gram sandbag in hand. The CG received conventional physiotherapy which were; mat activities, strengthening & stretching exercise & ambulation/gait training for 30 minutes 4 times/ week for 4 weeks. Pre & post- tests clinical data were collected & analyzed on SPSS 22 for spatial & temporal variables for CG & TG by using 10MWT & TUG (10-Meter walk test & Time up & Go test respectively) along with step length, cadence, cycle time & stride length. The independent variables of this RCT were a) CPT b) DTT & the dependent variables of the study were a) cadence b) stride length c) step length d) walking speed e) 10MWT f) TUG test. For the comparison demographic information of the left-hemiplegic patients independent- t-test was used & for the pre- & post interventions Paired-t-test was used for the comparison of dependent variables within the group data with the $P > 0.05$.

Results; Of the 32 patients, there were 16(50%) in each of the group that both had 18 males (56%) & 14 females (44%). Mean age recorded in CG was 58.20 ± 6.20 & in the TG 58.27 ± 6.12 years. Baseline clinical parameters among both groups were almost identical ($P > 0.05$). Post-test score showed improvement of gait variables (temporal & spatial), 10MWT-score, cadence, step-length, stride & cycle time in TG as compared to CG with $P < 0.05$. (Table-1)

Table-1: Comparison of the patient's demographic data of CG & TG

Variables	Treatment group (TG) N=16	Control group (CG) N=16
Age	58.27 ± 6.12 ($P=0.72$)	58.20 ± 6.20
Gender (Male)	9 (28%)	9 (28%)
(female)	7 (22%)	7 (22%)
Hemiplegic side	16 (100%)	16 (100%)

Pre-intervention mean step length of TG was 48.48 ± 3.5 cm & for the CG 47.87 ± 4.6 cm while post-intervention stride length for the TG 96 ± 8.2 cm & for the CG was 95.50 ± 9.4 cm. (Table-2)

Table-2: Comparison of the gait parameters score of CG & TG before treatment (baseline score)

Variables	Treatment group (TG) N=16	Control group (CG) N=16	P-value
Step length(cm)	48.48 ± 3.5	47.87 ± 4.6	0.36
Stride length (cm)	96 ± 8.2	95.50 ± 9.4	0.44
10MWT (cm/s)	85.34 ± 11.20	82.30 ± 12.8	0.55
TUG (s)	25.10 ± 2.4	26.74 ± 1.34	0.42
Cycle time (s)	1.25 ± 0.09	1.15 ± 0.08	0.40
Cadence (steps/min)	94.50 ± 3.45	95.50 ± 3.50	0.13

Post-intervention mean step length of TG was 56.48 ± 9.5 cm & for the CG 49.87 ± 3.6 cm while post-intervention stride length for the TG 105 ± 8.2 cm & for the CG was 98.50 ± 7.4 cm. (Table-3)

Table-3: Comparison of the gait parameters score of CG & TG after treatment

Variables	Treatment group (TG) N=16	Control group (CG) N=16	P-value
Step length(cm)	56.48 ± 9.5	49.87 ± 3.6	0.001
Stride length (cm)	105 ± 8.2	98.50 ± 7.4	0.01
10MWT (cm/s)	103.34 ± 8.20	80.30 ± 9.8	0.001
TUG (s)	10.10 ± 2.4	19.74 ± 2.34	0.001
Cycle time (s)	1.02 ± 0.037	1.11 ± 0.086	0.001
Cadence (steps/min)	104.50 ± 4.45	98.59 ± 3.90	0.001

Discussion; The result of this RCTs showed that gait speed of the left hemiplegic patients improved significantly which is consistent with a study carried on the chronic stroke patients with motor impairments^{23,25-27}. It has been reported that walking speed of 110-150 cm/s is considered sufficient in the most common social & environmental context³⁸. The walking speed significantly improved in this study from 85cm/s to 103cm/s (18cm/s increment) which is consistent with the findings of Dean et al & Iqbal et al in which they have reported 12.6cm/s & 16cm/s speed improvement respectively^{33, 17,28,29}. The mean age of the stroke patients enrolled in this study were 58.27 ± 6.12 (P=0.72) in the TG & 58.20 ± 6.20 in the CG which almost identical to other studies carried on the stroke patients¹. The results of this RCTs shows that all gait parameters improved due to the interventions of DTT except TUG which is consistent with the findings of other studies carried on stroke patients¹⁴⁻¹⁶, however, it is in contrast with the findings of another study which is carried out with 20 stroke patients 3 times/week for 4 weeks with the intervention of DTT & reported improved TUG score¹.

A quasi-experimental study reported considerable improvement in the cadence while no statistically significant improvement in other gait parameters such as; step length & stride length with the DTT interventions for a 40minuits session/day, 3time/week for 4 weeks¹¹⁻¹³. The difference in the findings of this quasi-experimental study can be explained as A) small sample size b) right hemiplegic stroke patient c) reduced DTT dose as compared to this RCs where the a) sample size was 32 b) the DTT dose given were 4 times/week for 4 weeks.

Significant motor dual task improvement has been reported by another study with the intervention of DTT which is consistent with the findings of this RCTs¹⁴. Inter-group analysis for the gait temporal & spatial parameters (step length, stride length & cadence) showed significant improvement which is comparable to the findings of this RCTs^{12,13}.

Conclusion; Dual-task training & conventional physical therapy significantly improves functional ability of the left-hemiplegic patients on all gait temporal & spatial parameters.

Limitations; It includes a) small sample size b) single center recruitment c) Uncontrollable confounding variables such as; medications, nutritional status, psychosocial status of the enrolled stroke patients.

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