

Comparative Effects of Motor and Cognitive Dual- Task Gait Training on balance and mobility in persons with Intellectual Disabilities - Randomized Controlled Trail - RCT

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ABSTRACT

Background: Dual tasks fall into two main groups: motor dual tasks, which require performance of a motor task and a postural control task at the same time; and cognition dual task that require performance of a cognition task and postural control task at the same time.

Aim: To focus on comparative effects of motor and cognitive dual-task gait training on balance and mobility in persons with intellectual disabilities

Methodology: A randomized clinical trial was conducted on 52 subjects (n=26) in a District Headquarter Hospital, Mirpur AJK. Fifty-two patients were randomly allocated in two groups as Group A received motor dual task and Group B received cognitive dual task training. Total duration of study was three weeks and assessment done before treatment and after every week. Rancho Los Amigos Cognitive Functional Scale (RLACF), Berg Balance Scale (BBS), Walking While Talking Test (WWT) and Stair Climb Test (SCT) for the assessment of the patient's improvement in skills, balance and mobility.

Results: The results of the study concluded that Rancho Los Amigos Cognitive Function Scale, Berg Balance Scale, Walking While Talking Test and Stair Climb Test scores were improved in both groups significantly. But on comparison; Cognitive dual task training significantly produce better results in improving the balance and mobility in the person with intellectual disability as compared to Motor dual task training with p value<0.005.

Conclusion: The study concluded that Cognitive dual task training is statistically and clinically more significant in improving the balance and mobility in the intellectual disable persons as compared to Motor dual task training.

Key words: Cognitive dual task, Intellectual disabilities, Motor and cognitive dual-task gait training.

INTRODUCTION

Intellectual disabilities (ID) are the social inclusion and exclusion policies which include those individuals who are physically disabled or mentally ill and excluded from the society and defined as intellectual disable person¹. These policies provide such individuals an overtime support for their survival in the community².

ID is prevalent among young people as it involves 1000 children of 5-19 years and adults of 20 years in 26 countries of the world (3). ID comprises 4-3% adult population of New South Wales, Irish. In the United State; and 70 million aged population(4). Aging and genetics are the main factor of ID. The other factors are sex, black race, socioeconomic status, and geographic area, premature birth, Cerebral palsy, and health professionals. ID developed due to the interactions of the patterns present in the family, copying style of the their parents, parents mental, financial and social support which affects delay in child's developmental pathway and cognitive domain. However, Intellectual disability considered as a major disadvantaged for such people⁵.

It mostly cause depression, anxiety, autism, attention deficit disorders or hyperactivity, decrease in mental age, neurological and medical problems^{6,7}. ID mostly affects logical reasoning, problem solving capacity, difficulty in learning new skills and verbal communication as it affects the basic understanding, performing their normal activities and interaction of the individual with the normal world⁸.

Cognitive-motor dual tasking protocol helps to improve walking timing, walking speed, dynamic and static balance and gait with execution of daily functional activities among neurological patients including Parkinsonism, stroke and geriatric populations^{9,10}.

Motor DTT helped in enhancing the stimulation of proprioceptors and visionary organs which enhance the vestibular

system that improve the balance and posture in ID¹¹. DTT mainly focused in regaining the center of the gravity position in the body on the axis of the gravitational force which affected by the change in the position due to disturbance at the visionary, vestibular and proprioceptors level at the normal daily activities. Eventually DTT lead to increase the postural and balance control in ID persons^{11,12}.

Wang R (2021) concluded that dual task training program produced significant improvement in executive functions with p= 0.014, CDT performance p < 0.001 along with walking ability p= 0.002 in comparison with other group. Results concluded Cognitive training is beneficial in increasing the community walking ability¹³. Oliva. H (2020) reported that dual task training played an important role in improving the mobility, develop postural stability and induced beneficial effect on the cognitive functions. Cognitive Dual task training also plays an important role in improving the memory, physical performance, gait and balance in the patients suffering from the cognitive related problems¹⁴.

The purpose of the study is to determine the role of CDT and MDT among the Intellectual disable people along with the improvement in balance control and mobility skills by using as treatment protocols for enhancing their walking and daily activities of life. As there is not a single study was conducted to determine the comparative effects of CDT and MDT techniques for assessing the improvement in balance and mobility especially in intellectual disability individuals. So, the current study was conducted in order to find the comparative effects of CDT and MDT in improving balance and mobility for the better understanding among intellectual disable patients.

MATERIAL AND METHODOLOGY

This was a single blinded randomized clinical trial conducted at District Headquarter Hospital, Mirpur AJK. Ethical consideration was taken from Ethical Committee of Riphah International University After approval from ethical review committee of Riphah and BASR; by using permission letter. Before data collection, all

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participants signed written consent forms approved by ethical committee of university institutional review board. Total 52 patients recruited in the study according to inclusion and exclusion criteria. The inclusion criteria of study was involving both male and female of 12-20 years having IQ range between 50-69¹⁵, having Grade I-IV on the RLACFS and Walk without assistive devices. Participants which were excluded were those who have any Genetic disorders (Down syndrome), Cerebrovascular accident, dementia, Cerebral palsy and had any Severe visual impairment and those who were using any Medications (sedatives or narcotics).

The included participants were having similar baseline variables included descriptive data such as age, gender, BMI, Walking while talking, RLACFS, SCT and berg balance scale and was assessed before and after study of all 2 groups. Randomization of patients were done by lottery method as participants selected for study, they were given consecutive numbers and assigned to the group indicated for each number.

The participants were randomly assigned to one of the two groups: Group A [Motor dual task gait training] and Group B [Cognitive dual task gait training] and all the exercises sessions were completed in 60 minutes for 4 days per week for consecutive six months. The tool that used were Rancho Los Amigos Cognitive Functional Scale, Berg Balance, and Walking While Talking Test and Stair Climb Test.

Procedure:

Group A: Motor dual task gait training was the protocol which performed by the patients after the measurement of the balance and gait ability (15). Patients were instructed to walk either on treadmill or on the land. During walk; patients were instructed to perform five tasks. The patients performed tossing and catching the ball, rehangng loops on hoops, buttoning and unbuttoning the shirts, holding the cup in water without the spilling and receiving with returning the water on treadmill or on the land according to patient's comfort. Each activity were supervised by therapist and the helper. Every activity performed for three minute by patient according to the proper guidelines. Each session lasted for 15 minutes for performing all the tasks and response of patient towards activities were recorded by therapist on the data sheet¹⁵.

Group B: Cognitive dual task gait training was the protocol which performed by the patients after the measurement of the balance and gait ability(15). Patients were instructed to walk either on treadmill or on the land. During walk; patients were instructed to perform five tasks. The patients performed sharp coloring, subtraction, counting, verbal analogical reasoning and backward spelling on treadmill or on the land according to patient's comfort. Each activity were supervised by therapist and the helper. Every activity performed for three minute by patient according to the proper guidelines. Each session lasted for 15 minutes for performing all the tasks and response of patient towards activities were recorded by therapist on the data sheet¹⁵.

Table 2: Table of post-treatment effects of RLACF , BBS, WWT and SCT

Groups	RLACF		BBS		WWT		SCT	
	Mean ± S.D		Mean ± S.D		Mean ± S.D		Mean ± S.D	
	Pre-treat	Post-treat	Pre-treat	Post-treat	Pre-treat	Post-treat	Pre-treat	Post-treat
MDT	2.86±0.967	5.78±0.998	34.3±2.07	38.7±2.09	247.69±12.28	252.43±12.31	16.34±2.64	13.02±2.62
CDT	2.97±0.153	2.97±0.153	34.3±2.07	44.26±2.21	247.7±12.26	257.52±12.44	16.34±2.64	8.47±2.47
p-value	0.751	0.000	0.902	0.000	0.000	0.000	0.939	0.000

DISCUSSION

The outcome measures of the study were assessed by using Ranchos Los Amigos Cognitive Functional scale (RLACFS), Walking While Talking Test (WWT), Stair climbing test (SCT) and Berg Balance Scale which considered as the reliable tools for measuring the improvement in the balance and the mobility in intellectual disable persons. The pre and post treatment values of both groups showed significant improvement in the balance and mobility problems by using MDT and CDT with p-value <0.05. But the on comparison; there was statistically significant difference observed that CDT yields better results with 8.13±0.814 while MDT

Data analysis: The Data analyzed through 24 SPSS software version. The normality of data was assessed by Koglomorv test's which concluded that statistical significance level was α = 0.05 in all analysis. Normality of data was assessed through Shapiro Wilk test of normality, p value was more than 0.05 (p<0.05) for all the variables so parametric tests were applied for the comparison of data.

RESULT

The results of the study showed that mean age in MDT group was 15.39±2.039, while in CDT group was 15.78± 2.25. While the gender distribution results showed that 12 (52.2%) were males and 11 (47.8%) were females in MDT group with 1.47±0.511. Results showed that in CDT group frequency and percentages in male were 14(60.9%). While in female frequency and percentages were 9(39.1%) with 1.39±0.499.

According to the within group analysis of RLACF as MDT had pre-treatment and post-treatment values were 2.86±0.967 and 5.78±0.998 respectively while CDT had pre-treatment and post-treatment values 2.97±0.153 and 8.13±0.132. The across group analysis of RLACF had post-treatment values were 5.78±0.998 and 8.13±0.132 respectively with p-value 0.000. The within group analysis of BBS as MDT had pre-treatment and post-treatment values were 34.3±2.07 and 38.7±2.09 respectively while CDT had pre-treatment and post-treatment values 34.3±2.07 and 44.26±2.21 respectively with p-value 0.000. The across group analysis of BBS had post-treatment values were 38.7±2.09 and 44.26±2.21 respectively with p-value 0.000.

The within group analysis of WWT as MDT had pre-treatment and post-treatment values were 247.69±12.28 and 252.43±12.31 respectively while CDT had pre-treatment and post-treatment values 247.7±12.26 and 257.52±12.44 respectively with p-value 0.000. The across group analysis of BBS had post-treatment values were 252.43±12.31 and 257.52±12.44 respectively with p-value 0.000. The within group analysis of SCT as MDT had pre-treatment and post-treatment values were 16.34±2.64 and 13.02±2.62 respectively while CDT had pre-treatment and post-treatment values 16.34±2.64 and 8.47±2.47 respectively with p-value 0.000. The across group analysis showed that post treatment SCT in MDT was 13.02± 2.619 and in CDT mean was 8.47 ± 2.47. Above all the results showed that Cognitive dual task gait training (CDT) is significantly effective in improving RLACF, BBS , WWT, and SCT in person with intellectual disabilities with p value <0.05.

Table 1: Demographic table of Group A and B:

Variables	MDT	CDT
	Mean ± S.D	Mean ± S.D
Age	15.39± 2.039	15.78± 2.25
Gender	1.47±0.511	1.39±0.499

5.782±0.98 was with p<0.05 in improving the balance problems in the intellectual disabilities. Previous studies showed significant effects of Cognitive dual task training and Motor dual task training in treating patients who were suffering from balance and mobility disorders. These both techniques are considered as the most effective protocols producing the positive effects in intellectual disable patients. Chua. LK et. al in 2021 conducted a study on physical cognitive dual task training in order to assess the disability level patients having during their daily activities of living. The whole sessions completed with 8.8 weeks with 2-3 sessions per week and concluded that cognitive dual task training is statistically yield better results as it improves the cognitive function and gait velocity

especially during walking while talking activities¹⁶. This study is accordance with this current study that confirmed CDT yields better results with 257.52 ± 12.40 with $p < 0.05$ in improving the dual tasking and balance problems in the intellectual disabilities.

Sukala et al in 2021 conducted a comparison study of cognitive and motor dual task training in treating balance by improving the postural alignment in the patients suffering from balance issues. The study concluded that CDT was more effective in improving the balance as compared to MDT as it provide better awareness about postural stability and correction of the posture alignments which played important role in restoring the balance during fall¹⁷. This study supported concurrent study results as Cognitive dual task training improved the cognitive functions regarding the movement and posture as compared to MDT with p -value < 0.05 . Guyot et al in 2020 and Joubert C et al in 2018 concluded that Cognitive dual task training helps in improving the cognitive, physical and normal daily life functions of the body. Such activities produce positive results in improving the balance and mobility in healthy and also in neurological persons as it reduce the fall incidence and enhance the postural stability^{18,19}. This study again support concurrent study results which strongly supported current study results.

Pena G et. al 2019 also support current study results that cognitive training played an important role in maintaining the inhibitory control as it produce positive changes in the inhibitory efficiency while walking which produce the change in the gait and provide better balance and mobility in the person²⁰. This study support current study results that cognitive training improves better results in treating gait speed by improving the balance.

Brustio et al 2018 conducted a study on the dual task training in treating the mobility and balance issues by using motor training along with the conventional treatment plan for 16 weeks as the study concluded that Motor dual task training improves the walking ability by improving the pressure on the food during walking tasks which increase the mobility of the person with p -value < 0.05 so it should be used as a single treatment protocol for improving mobility²¹. This study is in contrast with concurrent study as there is a significant changes have been observed in results by comparing it with CDT with p -value < 0.05 .

Ghai. S et.al in 2017 determine the effect of cognitive task training in balance by improving the weight distribution on limbs. The study concluded that dual task plays an important role in improving the postural stability by learning equal weight distribution on the limb in spite of the unstable base and visual restriction. The cognitive task training enhance in reducing the active contraction of muscles and muscular guarding which improves the stability of the posture²². This study again support concurrent study results as on comparison Cognitive training yields better results in improving BBS from Motor training with p -value < 0.05 .

Limitation and recommendation: The great benefit of current study is proving that both techniques applied on the patients safely without causing any damage to the patients and it shown that both techniques are effective in treating the balance and mobility but still Cognitive dual task training is better treatment protocol in increasing the balance and mobility due to its ability to improve the attention, reduce the distraction and confidence in persons. The strength of the study is that the study is the comparative single blinded randomized controlled trail conducted in the clinical set up in the intellectual disable person. Still; the study have some limitations like the study did not estimate the prolong effects as long- term follow data was not obtainable after treatment. The study finds it difficult to make them understand the right way of execution of the test and sessions on the treadmill due to their fear of fall. Due to their attention deficit behavior; the whole assessment and protocol session was time consuming and get irritating for patients.

CONCLUSION

Dual task gait training is highly effective in improving the symptoms among intellectual disable patients. However, cognitive dual tasking CDT is more effective technique in improving the balance and mobility in person with the intellectual disability than motor dual task gait training MDT.

Conflict of Interest: There is no conflict of interest between authors.

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