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ORIGINAL ARTICLE

Effectiveness of Abdominal Activation on Motor Control in Diplegic Cerebral Palsy: A Randomized Control Trial

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ABSTRACT

Background: Cerebral palsy (CP) is a disorder of the nervous system manifested in movement, posture, muscle tone, and functional activity. Poor postural control is the most common problem related to CP. Neuro-developmental techniques, or facilitation techniques, were used to activate muscles and improve trunk control.
Aim: To determine the influence of the effects of abdominal activation for correcting posture in spastic diaplegic CP children.
Methods: A quantitative, randomized clinical trial was conducted, allocating 26 CP patients randomly into two groups: the control group and the treatment group. Baseline treatment was given to the control group, which included lower-limb passive stretching exercises and interrupted direct current. However, baseline treatment with neuro-developmental techniques was given to the treatment group. The measuring tool used for assessment of postural correction and stability was the trunk control measurement scale.
Results: The study recruited 26 CP patients, of who 10 belonged to the age groups 8–10 years and 11–13 years, respectively, while 6 children were from the age group 14–15 years. An independent sample t-test was used for between-group analysis, and the results showed a significant improvement in the TCMS score post-treatment, as the p-value was 0.012, while within-group analysis was done by applying a paired sample t-test. There was a significant improvement in the treatment group (p-value 0.000) where NTD was applied, compared to the control group (p-value 0.096), where only baseline treatment was given.
Implication: Neurodevelopmental approaches can improve trunk control in children with cerebral palsy, enhancing mobility, independence, posture, and functional skills. This reduces the risk of musculoskeletal issues and facilitates activity participation.
Conclusion: The study showed significant improvement in postural control with the use of Neuro-developmental techniques in CP children. Children with cerebral palsy (CP) can benefit from improved trunk control using neurodevelopmental approaches, which can increase their mobility, independence, posture, ability to participate in activities, and functional skills.
Keywords: Cerebral palsy (CP), Neuro-developmental techniques (NDT), Interrupted direct current (IDC).

INTRODUCTION

Cerebral palsy is a disorder defined by impairment in movement and posture due to the abnormal development of the foetal or infant brain. It is a non-progressive condition, meaning that the brain damage does not worsen over time. The severity of cerebral palsy can vary widely, ranging from mild to severe. The disturbance of sensation, perception, cognition, and behaviour by epilepsy and by other musculoskeletal problems are the motor defects of cerebral palsy[1].

About 15 million people with cerebral palsy are estimated around the world, one third of whom have epilepsy, and more than half are mentally retarded[2]. There is an increased survival rate of premature newborns seen with the improvement in equipment present in hospital settings, the use of maternal and foetal medicine in high-risk pregnancies, and the advancement of pharmacological medicine for neonatal. Perinatal brain injury related to hypoxic ischemic encephalopathy, prolonged labour, and delivery has an incidence that is estimated to be 3.0 per 1000 live births. Perinatal brain injury is a lesion that shows deficits in cognitive, motor, and sensory function due to the changing structure of nervous tissue[3].

Cerebral palsy is characterised by limited stimulation of abdominal muscles and impaired planning of motor activities, which leads to decreased speed and force of muscular contraction. All the following factors contribute to balance and postural control disturbances in CP children.

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Poor postural control is one of the most debilitating impairments in children with CP. Poor muscle control may be the result of direct neural insult or the compensation of primary deterioration in muscle tone and neuromuscular activation[5]. Adding to these impairments is delayed muscular activation that results in top-down muscle contraction, and restriction in completing task-specific postural adjustments has also been well recognised[6, 7].

Bobath therapy is mostly used for children with cerebral palsy. Bobath therapy deals with the functional abilities of a cerebral palsy child. The purpose of the purpose of the treatment is to improve posture and muscle tone by using specific techniques[8]. The concept of bobath, or neurodevelopmental techniques, followed the concept of plasticity of the central nervous system along with motor control techniques that practice continuous patterns of inhibitory postural reflexes and normal patterns of movements from the daily activities of life[3]. Another most promising treatment is the application of functional electrical stimulation, where electric current is primarily used for stimulating the nerve supplying the underlying muscle, which causes muscle contraction to gain functionally useful movement[9,10]. Stretching exercises are the main component to treat spasticity and contractures in CP and maintain the joint range, along with improvements in muscle strength[11,12]. All of the above-mentioned treatments have proved to be effective for CP children in improving postural control.

The main aim of the current study was to assess the effect of abdominal activation on motor control in diaplegic CP.

METHODOLOGY

A randomized control trial was conducted at the Special Educational Schools of Faisalabad. Prior to the commencement of the study, ethical approval was obtained from the review board of the University of Faisalabad (IRB No.TUF/DEAN/2021/14, dated February 26, 2021). Children of both genders, ages 8–15, diagnosed with diaplegic CP were included. Children with tumours, severe mental abnormalities, sensory loss, any bony malalignment, contractures, and fractures were excluded from the study. A total of 26 samples was collected through simple random sampling techniques to enrol subjects from the population in the study, which was divided into groups A (n=13) and B (n=1).

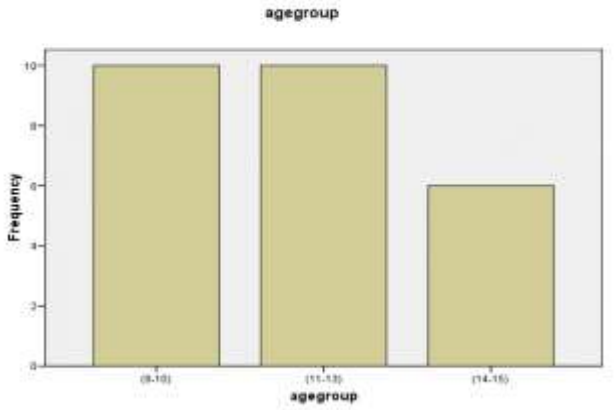
Baseline treatment was interrupted direct current (duration: 100 ms, frequency: 30 per minute) and passive stretching of all lower limb joints[13]. Group A (the control group) received the baseline treatment only, while Group B (the experimental group) received baseline treatment, neuro-developmental techniques, and traction. Both groups received therapy three times weekly for two months[14].

A trunk control measurement scale was used to measure trunk balance pre- and post-treatment. All outcome measures were recorded at the set time. Written informed consent was obtained from the participant's caregivers. Demographic data at the baseline was obtained in terms of age and gender. An independent sample t-test was used for between-group comparison, and a paired sample t-test was used for within-group analysis. The data was analysed on SPSS V.20, and the level of significance was set at 95% CI (p≤0.05).

RESULTS

A total of 26 participants were recruited, of whom 13 were boys and 8 were girls. 10 participants belonged to the age group 8–10 years, 10 were from the age group 11–13 years and 6 belonged to the age group 14–15 years (Figure 1).

Figure 1: Age Distribution of Patients



Results demonstrated a significant difference in TCMS score between groups after treatment by using an independent sample T test (p<0.05).

In the pre-test value of the independent sample T test, there was a non-significant difference in both groups on the trunk control measurement scale level, with a p-value 0.723 and a t-value of.358. and in the post-independent sample T test, significant results were found on G-1 and G-2 therapy on the truck control measurement scale with a p-value 0.012 and a t-value of 3.584 (Table 1).

In-group analysis was done by using a paired sample t-test. A non-significant improvement was observed in the pre- and post-treatment scores on TCMS in the control group, where only baseline treatment was applied with a p-value 0.096 (Table 2).

The pre- and post-treatment scores on TCMS in the experimental group showed significant improvement with a P-value of 0.000. This means that there were better results after the patient's treatment in the experimental group (Table 3).

Table 1: Between Group Analysis (Independent sample t-test)

Trunk Control Measurement Scale (TCMS)		N	Mean	S.D	T-Value	P-Value
Pre-test	Control	13	38.92	8.70	0.358	.723
	Treatment	13	40.76	8.31		
Post-test	Control	13	39.7692	9.27500	3.584	0.012
	Treatment	13	41.0769	9.33150		

Table 2: With in group Analysis for Control Group (Paired T Test)

Control Group	Mean	Df	Std. Deviation	p-value
Pre-Trunk control measurement scale & post-Trunk control measurement scale	2.76923	12	1.01274	.096

Table 3: With in group Analysis for Experimental Group (Paired T Test)

Experimental Group	Mean	df	Std. Deviation	p-value
Pre-trunk control measurement scale & post-trunk control measurement scale	3.692	12	1.074	.000

DISCUSSION

This study was a randomized control trial conducted on a convenient sample of 26 cerebral palsy children. The study found that there is a significant improvement in postural control with the activation of abdominal muscles through the use of neurodevelopmental techniques. The findings were significant for the experimental group.

The results of the current study were supported by two studies, which reported that treatment involving active participation of the patient in different patient-centred tasks resulted in better improvement in postural control and functional movement in cerebral palsied patients than the normal conventional treatment using exercises[15,16].

The effect of NDT on CP children was studied in 2018, where the effect of NDT was observed in 15 CP children aged between 5 and 15 years. A total of 2 sessions each of 60 minutes per week for 8 weeks were given, and the results showed significant improvement in postural control and balance in sitting as assessed by the GMFS classification and the seated postural control measure as the p-value obtained was 0.000. While in the current study similar results were obtained where NDT showed better and more significant improvement than conventional treatment[17].

RCT on the effect of electrical stimulation on postural control in 30 CP patients aged 8–12 years was conducted in 2021. Group 1 received traditional physical therapy treatment, including NDT and stretches, while group B received FES along with traditional treatment. The results showed that the use of stimulation enhances postural control in CP patients. While significant improvement was seen in both groups[18]. The following results are consistent with the current study, where postural control was improved in the group who received NDT.

This effect of stimulation has also been studied on affected muscles in order to produce a task-oriented movement to improve motor control of the muscle. By developing a muscle contraction during functional activities, it is believed the muscle may learn to contract over time and gain strength[19].

Karabey et al studied the effects of kinesiotaping and neuromuscular electrical stimulation along with NDT in an RCT conducted in 2016. For this purpose, they recruited 75 CP children, who were allocated to 3 different groups: the control group, the kinesiotaping group, and the neuromuscular electrical stimulation group. NNDT was given as a baseline treatment to all the groups.

The results showed greater improvement in the group with NMES along with NDT than with KT tapping and NDT[20]. The results are consistent with the current study, where NDT improved postural control in CP children.

Harbourne et al (2010) recruited 35 Cp children with milestones in adopting a sitting position and impaired postural control. The children were grouped into two groups: group A received a ome exercise plan, while group B received NDT for a period of about 8 weeks[21]. The results were consistent with the 8-week programme provided by an expert physiotherapist in the current study, which shows greater improvement in the group with NDT.

A systematic review by Buttler and Darah concluded that of 101 studies, 68 have proven no significant effects of neuro-developmental techniques as a treatment approach in comparison with other treatment approaches, and numerous studies have demonstrated greater improvements in the participants. Treatment ordered more frequently did not note to progress functional consequences[22]. On the other hand, the current study shows significant improvement in the mean scores of TCMS.

Limitation of study:

1. This study was conducted with a smaller sample size.
2. This study has a short treatment period.
3. This study covered only a sub-type of cerebral palsy (diaplegic cerebral palsied children).
4. The assessor was not blind to the purpose of the study.

CONCLUSION

Neuro-developmental techniques improve trunk control in children with CP, focusing on functional outcomes. So, if we improve the trunk control mechanisms, it will help to improve the functional abilities of children with cerebral palsy and Bobath's concept. Neuro-developmental techniques are appropriate treatments to activate abdominal muscles to increase the trunk control mechanism.

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