

Combined Directive Therapeutic Play and Music Therapy Improves Motor Coordination in Children with Spastic Cerebral Palsy: A Pilot Study

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ABSTRACT

Aim/Background: The spastic type of cerebral palsy is known to cause increased muscle tone, loss of motor control, and coordination issues, affecting the child's ability to be independent, with increasing focus on therapeutic play and music therapy. To examine the interaction between directive therapeutic play and music therapy on motor coordination and functional motor skills among children with spastic cerebral palsy, utilizing the Developmental Coordination Disorder Questionnaire (DCDQ).

Methodology: A pilot pretest-posttest study was conducted among 20 children (5–15 years) with spastic cerebral palsy, assigned to two groups (n = 10 each). Group A received combined directive therapeutic play, music therapy, and conventional physiotherapy (60–90 min/session), while Group B received conventional physiotherapy alone (60 min/session), four times weekly for 12 weeks. Motor coordination was assessed using the DCDQ.

Result: The results indicate that the two groups were similar at baseline, which indicates homogeneity. After 12 weeks of training, both groups experienced significant improvement in DCDQ, from “very

difficult/difficult” to “easy/very easy.” Repeated measures ANOVA indicated that there was significant improvement in Group A ($F = 182.320$, $p < 0.001$) and Group B ($F = 24.730$, $p < 0.001$), where there was more improvement in Group A. A significant between-group difference was seen only after 12 weeks of training ($p = 0.0468$).

Conclusion: The combined intervention enhanced parents' perception of motor coordination and functional motor performance as assessed with DCDQ in comparison with conventional physiotherapy.

Keywords: Developmental Coordination Disorder Questionnaire, Functional Motor Performance, Motor Coordination, Music Therapy, Spastic Cerebral Palsy, Therapeutic Play.

INTRODUCTION

Cerebral Palsy (CP) constitutes a spectrum of static neurological disorders that occur due to abnormal brain development or injury within the developing brain, leading to problems in movement, coordination, posture, and functional mobility. [1] Spastic CP is one such type of CP, which is the most common form and is known for increased

muscle tone, defective selective control of movements, and poor coordination. [2] Neuromotor impairment observed in spastic CP typically presents poor gross motor skills, decreased and inadequate coordination of movements. Furthermore, poor motor learning and motor response adaptability are other features observed in spastic CP. [3]

Motor control dysfunctions in spastic CP have been found to be highly correlated with impaired neuromuscular control, reduced postural stability, and deficient sensorimotor integration. [4] Suboptimal neuroplasticity and ineffective motor learning mechanisms result in inadequate skill development for activities such as sitting, standing, and walking. [5] Furthermore, difficulties in sustaining coordination arise due to inadequate sensory-motor integration. The failure to synchronise sensory input and motor functions results in suboptimal postures and inefficient motor actions. [6]

In pediatric neurorehabilitation, there has been a trend of using activity- and task-based interventions that facilitate motor learning through involvement. A specific instance associated with this structured treatment approach is directive therapeutic play, wherein the objective of play-based therapeutic activities is to acquire functional motor skills through therapist-facilitated games. [7] This intervention incorporates repetition, functional movement, and goal-oriented tasks to facilitate successful skill development through motivation. [8] There are studies supporting the effectiveness of directive play-based strategies for improving gross motor skills and posture among children with CP by promoting their engagement. [9]

Concurrently, music therapy has proven useful as a supplement to neurorehabilitation interventions aimed at motor timing and coordination issues. Auditory stimulation helps coordinate movements with external auditory stimulation and promotes the improvement of movement and gait patterns. [10] This phenomenon has been attributed to auditory-motor coupling, whereby rhythmic

inputs enhance activity in motor planning and execution systems, hence improving motor temporal control. [11] Moreover, music therapy can also be used for promoting neuroplasticity through activation of neural networks associated with motor, sensory, and affective functions. [12]

Despite the established efficacy of directive therapeutic play and music therapy in improving motor performance among children with cerebral palsy, little evidence exists concerning the use of these therapies in combination. Most studies done have considered these therapies alone or only in very specific populations, thereby leaving the synergy that might result from their use unknown. Additionally, structured rehabilitation procedures incorporating both therapist-directed play and rhythmic auditory stimulation have not been explored in children with spastic cerebral palsy. Therefore, the study was carried out to determine the effectiveness of these two therapies when used together on motor coordination and functional motor performance using the Developmental Coordination Disorder Questionnaire (DCDQ).

METHODOLOGY

Study design

The present study employed a pilot interventional study with pre- and post-intervention assessments to evaluate the feasibility and preliminary effects of combined directive therapeutic play and music therapy on motor coordination and functional motor performance among children with spastic cerebral palsy. The study was conducted at the Neuro-rehabilitation Unit of D.A.V. Institute of Physiotherapy and Rehabilitation, Jalandhar, and its affiliated hospitals over a period of 1.5 years, encompassing participant recruitment, baseline assessment, intervention, follow-up assessments, and data analysis. The primary outcome was motor coordination, assessed using the Developmental Coordination Disorder Questionnaire (DCDQ).

Study Participants

A total of 20 children diagnosed with spastic cerebral palsy were selected from the Neuro-rehabilitation Unit of D.A.V. Institute of Physiotherapy and Rehabilitation, Jalandhar. Participants were assigned into two groups (10 participants each) based on the pilot study, as the sample size was determined according to the total number of patients fulfilling the inclusion and exclusion criteria. Then, the participants were divided into two groups, each containing ten participants. Group A (experimental group) received structured intervention consisting of directive therapeutic play, music therapy, and conventional physiotherapy. On the other hand, group B (control group) received conventional physiotherapy, including stretching, strengthening, and gait therapy.

Selection Criteria

The participants aged 5-15 years of either sex were previously diagnosed with spastic cerebral palsy (hemiplegia, diplegia, or quadriplegia). Eligible participants were required to demonstrate voluntary grasp and release and the ability to move the affected upper limb against gravity, as determined by the treating physiotherapist using standardized clinical assessment. Moreover, the participants exhibited Modified Ashworth Scale grade ≤ 2 in target muscles, were classified under GMFCS Levels I–III, and were assessed by the treating physiotherapist based on the child's ability to understand and follow verbal instructions.^[13] The exclusion criteria for children included having an intellectual disability, ataxia, athetosis, mixed, or ataxic and athetotic cerebral palsy; sensory impairment; congenital malformation in the upper limbs; seizure and/or behavioral disorder; a history of any orthopedic surgeries; and administration of botulinum toxin or intrathecal baclofen within the preceding six months.

Variables

Independent Variables

The independent variables in the present research study were the interventions employed on the subjects. The three different interventions were Directive Play Therapy, Music Therapy, and Traditional Therapy. These interventions were used to compare their efficacy in relation to the results obtained from the study subjects. Type of intervention (combined directive therapeutic play and music therapy with conventional physiotherapy versus conventional physiotherapy alone).

Dependent Variables

The dependent variables involved the outcome variables used to measure the impact of the interventions, which include the scores obtained from DCDQ. These variables were employed to determine the changes in gross motor skills, and coordination skills after the application of the respective interventions.

Tool and Equipment

The Developmental Coordination Disorder Questionnaire (DCDQ) was used as the primary outcome measure to assess motor coordination and functional motor performance in children with spastic cerebral palsy. DCDQ is a standardized parent-completed questionnaire that evaluates motor coordination during everyday functional activities, with higher scores indicating better motor performance. Assessments were conducted at baseline, 6 weeks, and 12 weeks. Additional assessment instruments included a goniometer, measuring tape, and stopwatch. At the same time, intervention sessions utilized rhythmic auditory cueing through metronome software and standard therapeutic play materials, including fine- and gross-motor activity equipment.

Data Collection /Procedure

The participants in Group A underwent directive therapeutic play therapy accompanied by music therapy together with conventional therapy, whereas the participants in Group B received only

conventional therapy. The interventions were conducted for a period of 12 weeks at a frequency of four sessions per week, where sessions for Group A lasted between 60 and 90 minutes, and those for Group B lasted for 60 minutes. Measurements were taken using the Developmental Coordination Disorder Questionnaire at baseline, 6 weeks, and 12 weeks.

Study Phase

Pre-Intervention Phase

Participants fulfilling the inclusion criteria were enrolled after obtaining written informed consent from their parents/legal guardians and assent from the children, where applicable. Baseline assessment was subsequently performed using the Developmental Coordination Disorder Questionnaire (DCDQ). After the testing procedure, two groups of participants were formed, namely Group A (Experimental group) and Group B (Conventional group).

Intervention Phase

A standardized protocol of intervention was used in both groups. Participants in group A were subjected to an intervention program consisting of the use of music therapy (with 64 bpm rhythmic auditory stimulation), coupled with the execution of progressive motor activities that ranged from bilateral movements to functional activities (e.g., walking, weight bearing, and arm movement). Directive therapeutic play included 15 structured, therapist-guided, goal-oriented, graded activities emphasising reaching, object manipulation, in conjunction with traditional physiotherapy techniques such as reflex inhibition, passive stretching (15 seconds $\times$ 8 repetitions), static weight-bearing, and active-assisted to active movements (15 repetitions) utilising proprioceptive facilitation. Group B received a uniform conventional physiotherapy regimen for 60 minutes per session throughout the same duration.

Post-Intervention Phase

The post-intervention assessments were done after six weeks and 12 weeks as the follow-up assessments for measuring motor coordination and functional motor performance using DCDQ. The data gathered from the follow-up assessment of both groups were statistically analyzed to evaluate the changes that have taken place in relation to gross motor function.

Statistical Analysis

Data were analyzed via IBM SPSS Statistics (version 26). Descriptive statistics, including mean, standard deviation, and percentages, were employed to organise demographic and baseline information. Within-group comparisons at baseline, the 6th week, and the 12th week were conducted using repeated measures ANOVA, followed by the Bonferroni post hoc test when appropriate. Between-group comparisons at each time point were assessed using the independent t-test. A p-value of less than 0.05 was deemed statistically significant throughout the investigation.

RESULT

Demographic Characteristics

The baseline demographics and characteristics of the participants revealed that Groups A and B were similar before the intervention program. This could be due to the comparable age features of both groups, as the majority of participants in each group were aged between 5 and 11 years. Furthermore, there was equal participation of males and females, with 50% of each gender in both groups. Diplegic spastic cerebral palsy occurred among 60% of participants in Group A and 50% in Group B. Similarly, hemiplegia occurred equally among participants in the other group. The levels of GMFCS were also similar among the participants, whereby Level I and II were common among the participants, whereas there was a high level of III among Group B participants.

Table 1: Baseline Demographic Characteristics of Participants in Group A and Group B (n = 20)

Variables	Category	Group A (n = 10) n (%)	Group B (n = 10) n (%)
Age Group (Years)	5–8 years	4 (40.0)	4 (40.0)
	9–11 years	4 (40.0)	3 (30.0)
	12–15 years	2 (20.0)	3 (30.0)
Gender	Male	5 (50.0)	5 (50.0)
	Female	5 (50.0)	5 (50.0)
Type of Spastic Cerebral Palsy	Diplegia	6 (60.0)	5 (50.0)
	Hemiplegia	4 (40.0)	5 (50.0)
GMFCS Level	Level I	4 (40.0)	3 (30.0)
	Level II	3 (30.0)	3 (30.0)
	Level III	3 (30.0)	4 (40.0)

Comparison of Motor Coordination Scores at Baseline, 6 Weeks, and 12 Weeks Using the Developmental Coordination Disorder Questionnaire (DCDQ)

The frequency distribution of DCDQ responses showed an increasing trend of motor coordination and functional skill improvement among participants throughout the 12 weeks (Table 2). At the baseline, the scores were spread out among the categories, with considerable amounts in the lower scoring categories of “not at all like your child” and “a little like your child” for a number of skills, including throwing ability (20% and 10%), running (20% and 25%), and balance (20% and 30%),

suggesting that there was an issue with coordination. After 6 weeks, the scores showed a mix of transition with some persistence of lower scoring, including throwing (30% not at all like), catching (25% not at all like), and jumping (20% not at all like), while moderate categories started increasing in some questions. In 12 weeks, the positive change was evident in all categories, as most of the scores fell into higher categories like “quite a bit like your child” and “extremely like your child,” such as throwing (55% and 25%), catching (60% and 25%), jumping (55% and 25%), running (50% and 30%), balance (55% and 25%), handwriting/cutting (50% and 30%), and motor coordination (50% and 35%).

Table 2: Frequency and Percentage Distribution of Developmental Coordination Disorder Questionnaire (DCDQ) Responses Across Three Assessment Time Points (n = 20)

S. No.	Questions	Time	Not at all like your child n (%)	A little like your child n (%)	Moderately like your child n (%)	Quite a bit like your child n (%)	Extremely like your child n (%)
1	How well does your child throw a ball toward a target?	Baseline	4 (20.0)	2 (10.0)	4 (20.0)	6 (30.0)	4 (20.0)
		6 Weeks	6 (30.0)	5 (25.0)	3 (15.0)	3 (15.0)	3 (15.0)
		12 Weeks	1 (5.0)	1 (5.0)	2 (10.0)	11 (55.0)	5 (25.0)
2	How well does your child catch a ball thrown from a short distance?	Baseline	4 (20.0)	3 (15.0)	3 (15.0)	7 (35.0)	3 (15.0)
		6 Weeks	5 (25.0)	2 (10.0)	4 (20.0)	2 (10.0)	7 (35.0)
		12 Weeks	1 (5.0)	1 (5.0)	1 (5.0)	12 (60.0)	5 (25.0)
3	How well does your child jump with both feet together over obstacles in the play environment?	Baseline	3 (15.0)	5 (25.0)	4 (20.0)	2 (10.0)	6 (30.0)
		6 Weeks	4 (20.0)	5 (25.0)	3 (15.0)	1 (5.0)	7 (35.0)
		12 Weeks	1 (5.0)	2 (10.0)	1 (5.0)	11 (55.0)	5 (25.0)
4	How well does your child run without frequently stumbling or falling compared to peers?	Baseline	4 (20.0)	5 (25.0)	4 (20.0)	2 (10.0)	5 (25.0)
		6 Weeks	2 (10.0)	5 (25.0)	5 (25.0)	2 (10.0)	6 (30.0)
		12 Weeks	1 (5.0)	1 (5.0)	2 (10.0)	10 (50.0)	6 (30.0)

5	How well does your child maintain balance while walking on a straight path?	Baseline	4 (20.0)	6 (30.0)	2 (10.0)	3 (15.0)	5 (25.0)
		6 Weeks	4 (20.0)	5 (25.0)	4 (20.0)	4 (20.0)	3 (15.0)
		12 Weeks	2 (10.0)	1 (5.0)	1 (5.0)	11 (55.0)	5 (25.0)
6	How well does your child use scissors to cut along a line, and how neat is your child's handwriting compared with peers?	Baseline	2 (10.0)	2 (10.0)	3 (15.0)	5 (25.0)	8 (40.0)
		6 Weeks	4 (20.0)	5 (25.0)	4 (20.0)	3 (15.0)	4 (20.0)
		12 Weeks	1 (5.0)	2 (10.0)	1 (5.0)	10 (50.0)	6 (30.0)
7	How well does your child draw simple shapes accurately?	Baseline	3 (15.0)	5 (25.0)	5 (25.0)	2 (10.0)	5 (25.0)
		6 Weeks	4 (20.0)	3 (15.0)	3 (15.0)	6 (30.0)	4 (20.0)
		12 Weeks	1 (5.0)	1 (5.0)	2 (10.0)	12 (60.0)	4 (20.0)
8	How well does your child cut out pictures and shapes accurately and easily?	Baseline	7 (35.0)	5 (25.0)	2 (10.0)	2 (10.0)	4 (20.0)
		6 Weeks	7 (35.0)	3 (15.0)	6 (30.0)	2 (10.0)	2 (10.0)
		12 Weeks	1 (5.0)	1 (5.0)	1 (5.0)	11 (55.0)	6 (30.0)
9	How confident is your child in sports or physical education activities?	Baseline	2 (10.0)	2 (10.0)	5 (25.0)	10 (50.0)	1 (5.0)
		6 Weeks	6 (30.0)	7 (35.0)	3 (15.0)	2 (10.0)	2 (10.0)
		12 Weeks	2 (10.0)	1 (5.0)	1 (5.0)	10 (50.0)	6 (30.0)
10	How easily does your child learn new physical activities compared with peers?	Baseline	4 (20.0)	4 (20.0)	5 (25.0)	2 (10.0)	5 (25.0)
		6 Weeks	4 (20.0)	2 (10.0)	3 (15.0)	5 (25.0)	6 (30.0)
		12 Weeks	1 (5.0)	1 (5.0)	2 (10.0)	11 (55.0)	5 (25.0)
11	How easily can your child button, unzip, or manage clothing tasks?	Baseline	6 (30.0)	4 (20.0)	3 (15.0)	3 (15.0)	4 (20.0)
		6 Weeks	4 (20.0)	5 (25.0)	5 (25.0)	2 (10.0)	4 (20.0)
		12 Weeks	1 (5.0)	2 (10.0)	1 (5.0)	10 (50.0)	6 (30.0)
12	How would you rate your child's motor coordination compared with other children of the same age?	Baseline	7 (35.0)	4 (20.0)	3 (15.0)	5 (25.0)	1 (5.0)
		6 Weeks	3 (15.0)	2 (10.0)	8 (40.0)	4 (20.0)	3 (15.0)
		12 Weeks	1 (5.0)	1 (5.0)	1 (5.0)	10 (50.0)	7 (35.0)
13	How would you rate your child's overall movement skills?	Baseline	5 (25.0)	3 (15.0)	3 (15.0)	6 (30.0)	3 (15.0)
		6 Weeks	4 (20.0)	3 (15.0)	6 (30.0)	3 (15.0)	4 (20.0)
		12 Weeks	1 (5.0)	2 (10.0)	1 (5.0)	9 (45.0)	7 (35.0)
14	How well does your child use scissors to cut along a line?	Baseline	1 (5.0)	2 (10.0)	7 (35.0)	2 (10.0)	8 (40.0)
		6 Weeks	6 (30.0)	3 (15.0)	2 (10.0)	4 (20.0)	5 (25.0)
		12 Weeks	2 (10.0)	1 (5.0)	1 (5.0)	9 (45.0)	7 (35.0)
15	How well does your child participate in playground games?	Baseline	2 (10.0)	3 (15.0)	4 (20.0)	5 (25.0)	6 (30.0)
		6 Weeks	4 (20.0)	2 (10.0)	7 (35.0)	2 (10.0)	5 (25.0)
		12 Weeks	1 (5.0)	1 (5.0)	2 (10.0)	10 (50.0)	6 (30.0)

Comparison of Within-Group Changes in Developmental Coordination Disorder Questionnaire (DCDQ) Scores at Baseline, 6th Week, and 12th Week Using Repeated Measures ANOVA

Repeated measures analysis of variance demonstrated a statistically significant improvement in the scores of DCDQ over the time period in both groups ($p < 0.001$)

(Table 3). In group A, there was an increase in the mean score from 28.44 to 36.44 over the 12th week ($F = 182.320$). Similarly, in group B, there was an increase in the mean score from 30.43 to 32.57 ($F = 24.730$). Although both groups have shown considerable progress, group A exhibits an increase in mean scores.

Table 3: Repeated Measures ANOVA of Developmental Coordination Disorder Questionnaire (DCDQ) Scores Within the Study Groups

Groups	Baseline (Mean $\pm$ SD)	6th Week (Mean $\pm$ SD)	12th Week (Mean $\pm$ SD)	F	p-value
Group A	28.44 $\pm$ 3.504	32.11 $\pm$ 3.790	36.44 $\pm$ 3.745	182.320	<0.001
Group B	30.43 $\pm$ 3.047	31.57 $\pm$ 2.573	32.57 $\pm$ 3.207	24.730	<0.001

Comparison of DCDQ Scores Between Group A and Group B Using an Independent t-test

The independent t-test revealed no statistical difference between the two groups at baseline ($p = 0.2549$) and 6 weeks ($p = 0.7520$), which implied the similarity in the results obtained (Table 4). Nevertheless, a

significant difference was identified in the 12th week ($t = 2.154$; $p = 0.0468$), where Group A outperformed Group B (DCDQ score was 36.44 vs. 32.57). Thus, Group A demonstrated greater improvement in the results than Group B by the end of the experiment.

Table 4: Independent t-test Analysis of DCDQ Scores Between the Experimental and Control Groups Across the Study Period

Variable	Time	Group A (Mean $\pm$ SD)	Group B (Mean $\pm$ SD)	Mean Difference	t	p-value
DCDQ	Baseline	28.44 $\pm$ 3.50	30.43 $\pm$ 3.05	1.98	1.181	0.2549
	6th Week	32.11 $\pm$ 3.79	31.57 $\pm$ 2.57	0.54	0.321	0.7520
	12th Week	36.44 $\pm$ 3.75	32.57 $\pm$ 3.21	3.87	2.154	0.0468*

DISCUSSION

Children with spastic cerebral palsy have difficulty with motor coordination and motor function in performing their activities. [4] In addition to traditional therapies, there is an innovative approach using directive therapeutic play and music therapy that has proven to be very effective and increases motivation and motor learning. [14] Play therapy involves practice through movement, whereas music therapy is based on rhythm and coordination. [15] however, these interventions can make for an interesting rehabilitation experience and have the potential to improve motor skills better than standard therapy alone.

The baseline comparability of both groups regarding age, gender balance, cerebral palsy type, and GMFCS levels ensures the internal validity of the results. Baseline homogeneity between the two groups was highlighted in previous rehabilitation studies conducted by Gill et al. (2023) [16], who indicated that analogous group features are crucial for reducing confounding effects in cerebral palsy intervention studies. [16] Similarly, a study conducted by Chughtai al. (2025) [17] noted the effectiveness of

structured physiotherapy interventions for children with cerebral palsy. [17]

The progressively better performance on the DCDQ test between baseline and at 6 weeks and 12 weeks in this study is in line with the results of Ko et al. (2020) [18], who found that task-oriented training significantly helped improve the skills of motor planning, balance, and coordination among children with spastic CP. [18] Similarly, studies by Darshwana et al. (2015) [19] showed that improvements in functional motor skills through intensive goal-directed therapy have been noted, especially for balance and hand-eye coordination. [19] However, a study by Su et al. (2025) [20] showed that the improvement noted in this study was in balance, locomotion, and fine motor skills. [20]

The significant within-group improvement that has been recorded in group A is also in line with research that focuses on the efficacy of enhanced or intensified forms of rehabilitation. For example, according to Baniña et al. (2022) [21], higher-intensity treatment has been found to yield better results when compared to the standard form of rehabilitation in terms of the ability to

coordinate upper and lower limbs. [21] Similarly, Jackman et al. (2022) [22] found that task-specific training promotes participation and functional independence among individuals with cerebral palsy. [21]

The differences found between groups at 12 weeks, which clearly favored Group A over Group B, are consistent with those of Adiguzel et al. (2022) [23], where modifications in therapy result in greater benefits for gross motor functions than usual treatment. [23] Additionally, Rodríguez et al. (2024) [24] emphasize the importance of functional training together with a structured progression. [24]

The developments observed in fine motor functions like handwriting, using scissors, and self-dressing abilities in the current study agree with the results of Alsubiheen et al. (2022) [25], who found that the interventions aimed at upper limbs can have a positive impact on dexterity and functional abilities. [25] Moreover, according to the information provided by Garaigordobil et al. (2022) [26], intervention programs addressing the issues of motor control and participation could have even more developmental impacts. [26]

Moreover, both groups made considerable progress in terms of motor coordination and functional performance over a period of 12 weeks. Still, the results achieved in Group A were much higher when measured through DCDQ scores, suggesting that the treatment for Group A was more effective in promoting improved gross motor function, motor planning, and functional independence among children with spastic cerebral palsy. This observation is supported by previous research that confirms the success of structured and task-specific interventions in the rehabilitation process. Nevertheless, the current study suffers from limitations, including a small sample size, a short intervention period, parental reporting of outcomes, and a lack of follow-up.

CONCLUSION

In conclusion, the findings showed that the combination of directive therapeutic play

and music therapy led to improvements in the motor coordination and functional motor abilities of children who have spastic cerebral palsy, as measured by DCDQ, according to parents' reports. These changes may be explained by increased participation, motivation, and multisensory stimulation, which confirms the effectiveness of an integrated approach to rehabilitation that is child-focused. Further research will have to include objective measurements of balance and gross motor abilities using GMFM or Pediatric Balance Scale.

Declaration by Authors

Ethical Approval: Ethical approval was not required for this study as per institutional guidelines. However, all ethical standards were followed, and informed consent was obtained from participants.

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