

Original Article

Comparative Effects of Functional Task Training Versus Functional Therapy Program on Gross Motor Function, Range of Motion, and Balance in Children With Cerebral Palsy

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ABSTRACT

Background: Cerebral palsy (CP) is a non-progressive neuromotor disorder affecting the developing fetal or newborn brain, leading to impairments in muscle tone, reflexes, posture, coordination, and motor skills. Functional Task Training (FTT) and Functional Therapy Programs (FTP) are rehabilitation techniques aimed at improving the physical capabilities of children with CP.

Objective: To determine the comparative effects of Functional Task Training versus a Functional Therapy Program on gross motor function, range of motion, and balance in children with hemiplegic cerebral palsy.

Methods: This randomized clinical trial was conducted from March 2, 2023, to May 31, 2023, at Rising Sun for Special Children in Lahore. A sample of 18 children, aged 6-12 years, diagnosed with hemiplegic cerebral palsy (GMFCS level I-II), was randomly assigned to two groups: Group A received FTT, and Group B received FTP. Both groups underwent their respective interventions for 50 minutes per day, three times a week, over 12 weeks (36 sessions). Data collection tools included the Goniometer for range of motion (ROM), Pediatric Balance Scale (PBS) for balance, and Gross Motor Function Measure (GMFM-88) for motor function. Baseline and post-intervention assessments were conducted. Statistical analysis was performed using SPSS version 25, with paired and independent t-tests to compare pre- and post-intervention scores within and between groups, respectively. A p-value of less than 0.05 was considered statistically significant.

Results: The mean age of participants was 8.67±2.39 years in Group A and 9.89±1.96 years in Group B. No significant differences were found between the two groups in GMFM domains A, B, C, and E, or in the total GMFM score ($p > 0.05$). Post-intervention GMFM total scores were 83.11±2.09 in Group A and 84.33±3.42 in Group B ($p = 0.375$). PBS scores showed no significant differences post-intervention, with mean scores of 36.66±5.02 in Group A and 41.33±7.57 in Group B ($p = 0.140$). ROM measures indicated significant improvements within Group A in left hip flexion, abduction, and extension ($p < 0.05$).

Conclusion: Both Functional Task Training and Functional Therapy Programs were equally effective in improving gross motor function, balance, and range of motion in children with hemiplegic cerebral palsy. These findings support the use of both interventions as effective rehabilitation strategies in this population.

Keywords: Cerebral palsy, Functional Task Training, Functional Therapy Program, Gross Motor Function, Pediatric Balance Scale, Range of Motion, Pediatric Rehabilitation, Hemiplegic CP, Randomized Clinical Trial. Management

INTRODUCTION

Cerebral palsy (CP) is a non-progressive neuromotor disorder that affects the developing fetal or newborn brain, resulting in a spectrum of motor and postural dysfunctions. This condition manifests in early infancy and persists throughout life, significantly impacting muscle tone, reflexes, posture, coordination, gait, and both gross and fine motor skills (1). Hemiplegic cerebral palsy, a subtype of spastic hemiplegia, affects one side of the body, leading to notable muscle weakness, loss of sensation, asymmetry in limb length, and a range of other physical impairments (2). This type of CP is prevalent in approximately 33% of children with CP, making it a critical focus for therapeutic interventions (3).

The primary goal of physical therapy in managing CP is to enhance the patient's functional independence by improving muscle strength, motor skills, and overall mobility. The rehabilitation strategies employed often include a combination of heat therapy, stretching, massage, and the use of specific equipment tailored to the individual's needs (4). Functional physical therapy emphasizes teaching motor skills that are relevant to the child's environment, thereby enhancing their quality of life and gross motor function (5). In particular, task-oriented training has been shown to be effective in improving the motor functions and daily life activities of children with CP, fostering better balance and stability (6).

Children with CP often struggle with activity and engagement levels due to impaired balance control, which imposes significant restrictions on their ability to perform functional tasks in daily life (7). These limitations are especially pronounced in children with hemiplegic CP, who exhibit considerable difficulty in performing activities that require bilateral coordination and balance (8). Physical therapy interventions aim to mitigate these challenges by focusing on the enhancement of gross motor functions, balance, and range of motion (ROM) through structured and repetitive training protocols (9).

A well-documented phenomenon in pediatric rehabilitation is the concept of neuronal plasticity, which underpins the effectiveness of task-oriented training. Neuronal plasticity refers to the brain's ability to reorganize itself by forming new neural connections, particularly in response to learning and practice (10). This principle is crucial in the context of CP, where consistent and targeted physical therapy can lead to significant improvements in motor functions (11). Functional task training (FTT) and functional therapy programs (FTP) are two rehabilitation strategies that leverage this concept, aiming to improve the gross motor function, balance, and ROM in children with CP (12).

This study is designed to compare the effects of functional task training versus a functional therapy program on gross motor function, balance, and range of motion in children with hemiplegic cerebral palsy. By evaluating the efficacy of these two distinct therapeutic approaches, the study seeks to determine which method offers superior benefits in enhancing the physical capabilities of children with CP (13). The findings of this research will provide valuable insights into the optimal strategies for managing CP and improving the quality of life for affected individuals (14).

MATERIAL AND METHODS

This randomized clinical trial, registered under NCT-05903508, was conducted from March 2, 2023, to May 31, 2023, at Rising Sun for Special Children in Lahore. The study aimed to compare the efficacy of Functional Task Training (FTT) and Functional Therapy Program (FTP) in improving motor functions in children with hemiplegic cerebral palsy. The sample size was determined using the Open EPI tool based on previous studies with inputs of Mean 1=41, Variance 1=6, Mean 2=37, and Variance 2=5, with a confidence level of 95% and power of 80%. The initial sample comprised 22 participants to account for a 10% attrition rate, but 4 participants (2 from each group) were lost to follow-up, resulting in 18 participants completing the study.

Eligibility criteria included both male and female children aged 6-12 years, diagnosed with hemiplegic cerebral palsy, classified under GMFCS level I-II, and capable of following commands. Children with deformities such as scoliosis, pelvic or hip deformity, visual disorders, a history of orthopedic surgery, or mental retardation were excluded from the study. Participants were selected using convenience sampling and randomly assigned to one of the two study groups using a coin toss method. Group A received Functional Task Training, while Group B underwent the Functional Therapy Program. Both interventions were administered for 50 minutes per day, three times a week, over a period of 12 weeks, totaling 36 sessions.

Data collection involved the use of several assessment tools. The Goniometer was used to measure the range of motion (ROM). The Pediatric Balance Scale (PBS), a 14-item scale with a total score of 56 points, was used to assess balance across various positions, including sitting, standing, and shifting. The Gross Motor Function Measure (GMFM-88) was employed to evaluate changes in gross motor function over time, given its high reliability in clinical settings (15). Baseline and post-intervention assessments were conducted for all participants using these tools.

The study was approved by the Research Ethical Committee of Riphah International University, Lahore, ensuring compliance with the ethical principles outlined in the Declaration of Helsinki. Informed consent was obtained from the guardians of all participants prior to their inclusion in the study. The confidentiality and anonymity of the participants were maintained throughout the research process.

Data were analyzed using SPSS version 25. Descriptive statistics were calculated for demographic variables and baseline characteristics. The effectiveness of the interventions was evaluated using paired t-tests to compare pre- and post-intervention scores within each group. Independent t-tests were used to compare the outcomes between the two groups. A p-value of less than 0.05 was considered statistically significant. The results were presented as mean values with standard deviations, and confidence intervals were provided where appropriate.

The study followed a rigorous protocol to ensure the validity and reliability of the findings. All assessments were conducted by trained professionals who were blinded to the group assignments to minimize bias. The randomization process and intervention protocols were strictly adhered to, ensuring consistency across the study. The data analysis was performed with careful attention to detail, ensuring accurate interpretation of the results (16).

RESULTS

The study initially included 22 participants; however, 4 participants (2 from Group A and 2 from Group B) were lost to follow-up, resulting in 18 participants who completed the study. The mean age of participants in Group A was 8.67 ± 2.39 years, while the mean age in Group B was 9.89 ± 1.96 years. The distribution of participants by gender revealed that 67% were males and 33% were females.

Table 1: Mean Age and Standard Deviation by Group

Group	Mean Age (years)	Standard Deviation (years)
Group A	8.67	2.39
Group B	9.89	1.96

Baseline comparison of GMFM-88 scores between Group A and Group B indicated that variables were similar at baseline ($p > 0.05$). Post-treatment comparison showed no significant differences between the two groups in GMFM domains A, B, C, and E, as well as in the total GMFM score ($p > 0.05$).

Table 2: Comparison of GMFM-88 Scores Between Groups

GMFM-88 Domain	Group A (FTT) Mean \pm SD	Group B (FTP) Mean \pm SD	95% CI	p-value
Pre GMFM-A	92.44 \pm 2.40	91.11 \pm 1.05	-0.52	0.147
Post GMFM-A	92.44 \pm 2.40	92.22 \pm 2.11	-2.04	0.837
Pre GMFM-B	94.44 \pm 2.60	93.44 \pm 1.94	-1.18	0.346
Post GMFM-B	94.66 \pm 2.00	93.66 \pm 1.41	-0.73	0.238
Pre GMFM-C	86.33 \pm 3.31	86.88 \pm 3.62	-4.03	0.739
Post GMFM-C	87.22 \pm 3.52	86.88 \pm 3.62	-3.24	0.846
Pre GMFM-D	71.22 \pm 6.15	74.33 \pm 5.91	-9.15	0.291
Post GMFM-D	71.55 \pm 5.65	77.66 \pm 7.67	11.89	0.039
Pre GMFM-E	69.33 \pm 7.04	70.55 \pm 10.35	-10.07	0.773
Post GMFM-E	70.88 \pm 7.83	72.33 \pm 10.46	-10.68	0.745
Pre GMFM Total	82.22 \pm 2.05	82.77 \pm 3.89	-3.66	0.710
Post GMFM Total	83.11 \pm 2.09	84.33 \pm 3.42	-4.05	0.375

Baseline comparison of PBS scores between Group A and Group B showed that variables were similar at baseline ($p > 0.05$). Post-treatment comparison revealed no significant differences between the two groups ($p > 0.05$).

Table 3: Comparison of Pediatric Balance Scale Scores Between Groups

PBS	Group A (FTT) Mean \pm SD	Group B (FTP) Mean \pm SD	95% CI	p-value
Pre PBS	34.88 \pm 5.11	39.22 \pm 8.39	-11.27	0.200
Post PBS	36.66 \pm 5.02	41.33 \pm 7.57	-11.08	0.140

Baseline comparison of ROM between Group A and Group B indicated that variables were similar at baseline ($p > 0.05$). Post-treatment comparison showed no significant differences between the two groups for all ranges of motion ($p > 0.05$), except for pre- and post-treatment measurements in left hip flexion, left hip abduction, and left hip extension, which showed significant differences within Group A ($p < 0.05$).

Table 4: Comparison of Range of Motion Between Groups

Group A		Mean S.D	M.D	p-value
Domain A	Pre treatment	92.44 \pm 2.4	-.30086	P > 0.05
	Post treatment	92.44 \pm 2.40		
Domain B	Pre treatment	94.44 \pm 2.603	-.73467	p > 0.05
	Post treatment	94.66 \pm 2.000		

Domain c	Pre treatment	86.33±3.316	-1.69914	P<0.05
	Post treatment	87.22±3.527		
Domain D	Pre treatment	71.22±6.159	-.87686	P>0.05
	Post treatment	71.55±71.55		
Domain E	Pre treatment	69.33±7.035	-2.42445	P<0.05
	Post treatment	70.88±7.83		
Total GMFS	Pre treatment	82.22±2.048	-1.14511	P<0.05
	Post treatment	83.11±2.088		

In conclusion, the results demonstrated that both functional task training and functional therapy programs were effective in improving gross motor function, balance, and range of motion in children with hemiplegic cerebral palsy. There were no significant differences between the two groups, indicating that both interventions are equally beneficial for this population.

DISCUSSION

The present study aimed to compare the effects of Functional Task Training (FTT) and a Functional Therapy Program (FTP) on gross motor function, balance, and range of motion in children with hemiplegic cerebral palsy. The findings indicated that both interventions were equally effective, with no significant differences between the two groups. These results align with previous research, which has shown that task-oriented training can significantly enhance motor functions and daily life activities in children with cerebral palsy (17,18).

The improvements observed in both groups underscore the efficacy of structured and repetitive training protocols in pediatric rehabilitation. Functional Task Training, which emphasizes task-specific activities, and the Functional Therapy Program, which incorporates goal-directed exercises, both capitalize on the principles of neuronal plasticity. This phenomenon, crucial in pediatric rehabilitation, suggests that the brain's ability to reorganize itself through new neural connections can lead to substantial improvements in motor functions when exposed to consistent and targeted physical therapy (19).

Previous studies have also highlighted the benefits of task-oriented training in improving gross motor function and balance. For instance, Na-Yun Lee et al. demonstrated that dual-task training significantly improved dynamic stability and gross motor skills in children with spastic diplegia, which parallels the findings of the current study, where both FTT and FTP showed significant improvements in gross motor function and balance (17). Similarly, Zai et al. (2022) and Azadi et al. (2020) found that task-oriented training effectively enhances gross motor function, balance, and activities of daily living in children with cerebral palsy (19)(20).

Despite these promising results, the study had several limitations. The sample size was relatively small, which may limit the generalizability of the findings. Additionally, the short duration of the intervention period might not capture the long-term effects of the training programs. Future studies should consider larger sample sizes and longer follow-up periods to validate these findings and explore the sustained impacts of these interventions. Another limitation was the reliance on convenience sampling, which could introduce selection bias. Randomized controlled trials with larger, more diverse populations are needed to confirm the efficacy of these interventions across different demographics (20).

Strengths of the study included the rigorous methodological approach, adherence to ethical standards, and the use of reliable and valid assessment tools. The study was conducted in compliance with the ethical principles outlined in the Declaration of Helsinki, ensuring the protection of participants' rights and well-being (15). The use of well-established measures such as the GMFM-88, Pediatric Balance Scale, and Goniometer provided robust data on the participants' functional abilities.

In conclusion, both Functional Task Training and the Functional Therapy Program were found to be effective in improving gross motor function, balance, and range of motion in children with hemiplegic cerebral palsy. These findings suggest that task-oriented and goal-directed training programs can be integral components of pediatric rehabilitation, offering significant benefits for children with cerebral palsy. Future research should aim to expand on these findings by exploring the long-term effects of these interventions and their applicability in different clinical settings. Additionally, incorporating multi-disciplinary approaches and personalized rehabilitation plans could further enhance the outcomes for children with cerebral palsy, ultimately improving their quality of life and functional independence.

CONCLUSION

Both Functional Task Training and Functional Therapy Programs were equally effective in improving gross motor function, balance, and range of motion in children with hemiplegic cerebral palsy. These findings support the use of both interventions as effective rehabilitation strategies in this population.

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