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Effect of task-oriented motor training on gross motor function and balance in children with Spastic Diplegic Cerebral Palsy: An experimental study

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Abstract
Background: Cerebral palsy (CP) is a leading cause of childhood motor disability, often resulting in limitations in gross motor function, balance, and functional independence. Contemporary pediatric physiotherapy emphasizes activity-based, task-oriented approaches to enhance motor learning and neuroplasticity.
Aim: To determine the effectiveness of task-oriented motor training on gross motor function and balance in children with spastic diplegic cerebral palsy.
Objectives:
1. To assess gross motor function before and after task-oriented motor training.
2. To assess balance before and after task-oriented motor training.
3. To compare pre- and post-intervention outcomes.

Methodology: A pre–post experimental study was conducted on 30 children with spastic diplegic cerebral palsy (GMFCS levels II–III), aged 5–10 years. Participants received task-oriented motor training for 45 minutes/day, 5 days/week, for 6 weeks. Outcome measures included the Gross Motor Function Measure-88 (GMFM-88) and Pediatric Balance Scale (PBS). Statistical analysis was performed using paired t-test.
Results: Significant improvement was observed in GMFM-88 and PBS scores post-intervention ($p < 0.001$).
Conclusion: Task-oriented motor training is an effective intervention for improving gross motor function and balance in children with spastic diplegic cerebral palsy.

Keywords: Cerebral palsy, pediatric physiotherapy, task-oriented training, gross motor function, balance

Introduction

Cerebral palsy is defined as a group of permanent, non-progressive disorders of movement and posture caused by disturbances in the developing fetal or infant brain [1]. The global prevalence of cerebral palsy is approximately 2–3 per 1,000 live births [2]. Spastic diplegia is the most common clinical subtype, predominantly affecting the lower limbs and resulting in impaired mobility and balance [3].

Children with spastic diplegic cerebral palsy commonly present with muscle weakness, spasticity, impaired postural control, and poor selective motor control, leading to functional limitations and restricted participation in daily activities [4]. Conventional physiotherapy interventions have traditionally focused on impairment-based approaches: however, such approaches may not consistently translate into functional improvements [5].

Task-oriented motor training is based on motor learning principles and emphasizes repetitive practice of meaningful, functional tasks within real-life contexts [6]. This approach facilitates experience-dependent neuroplasticity and enhances neuromuscular coordination [7]. Evidence increasingly supports activity-based interventions for improving functional outcomes in children with cerebral palsy [8, 9]. However, experimental evidence from Indian pediatric populations remains limited. Therefore, this study aimed to evaluate the effectiveness of task-oriented motor training on gross motor function and balance in children with spastic diplegic cerebral palsy.

Materials and Methods

Study Design

Pre–post experimental study

Study Setting

Pediatric Physiotherapy centres, surat

Study Duration

6 weeks

Sample Size

30 children

Sampling Technique

Convenience sampling

Eligibility Criteria

Inclusion Criteria

- Children aged 5–10 years
- Diagnosed with spastic diplegic cerebral palsy
- GMFCS level II or III
- Ability to follow simple verbal instructions
- Stable medical condition

Exclusion Criteria

- Orthopedic surgery or botulinum toxin injection in past 6 months
- Uncontrolled seizure disorders
- Severe visual or auditory impairment
- Severe cognitive impairment

Outcome Measures

Gross Motor Function Measure-88 (GMFM-88): GMFM-88 is a standardized, valid, and reliable observational instrument designed to evaluate changes in gross motor function in children with cerebral palsy [11].

Pediatric Balance Scale (PBS): PBS is a modified version of the Berg Balance Scale developed to assess functional balance in children with mild to moderate motor impairment [12].

Intervention Protocol
Participants received Task-Oriented Motor Training under supervision of a pediatric physiotherapist.
Session Duration: 45 minutes
Frequency: 5 days per week
Total Duration: 6 weeks

Training Components:
- Sit-to-stand transitions
- Static and dynamic standing balance activities
- Walking on varied surfaces
- Stair climbing
- Reaching and grasping activities in standing
- Obstacle negotiation

Each task was progressed based on the child's performance and functional ability.
Training intensity and task complexity were progressed based on individual performance, following principles of motor learning and repetition [6,7].

Ethical Considerations
NOC was obtained from Each Pediatric Physiotherapy centres of Surat. Written informed consent was obtained from parents/guardians prior to participation.

Statistical Analysis
Data were analyzed using SPSS version 20. Descriptive statistics were used to calculate mean and standard deviation. Paired t-test was used to compare pre- and post-intervention scores. Statistical significance was set at $p < 0.05$.

Results

Table 1: Comparison of Pre- and Post-Intervention Scores

Outcome Measure	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	t-value	p-value
GMFM-88 (%)	62.4 ± 7.1	71.8 ± 6.5	8.32	<0.001
PBS	36.2 ± 5.4	42.7 ± 4.9	7.94	<0.001

Statistically significant improvement was observed in both outcome measures following the intervention.

Discussion
The results of the present experimental study demonstrate that task-oriented motor training significantly improves gross motor function and balance in children with spastic diplegic cerebral palsy. Improvement in GMFM-88 scores suggests enhanced functional mobility, transitional movements, and lower limb motor control.
Task-oriented training emphasizes repetitive practice of functional activities, which facilitates cortical reorganization and motor learning [7, 13]. Similar findings have been reported in previous studies where functional, goal-directed therapy resulted in superior motor outcomes compared to traditional impairment-based interventions [8, 9, 14].
Improvement in balance, as measured by PBS, may be attributed to enhanced anticipatory and reactive postural control developed through dynamic functional tasks [15]. Improved balance has been associated with better walking efficiency and increased participation in daily activities [16].
The findings align with the International Classification of Functioning, Disability and Health (ICF) framework, which emphasizes activity and participation-oriented rehabilitation [17]. Recent systematic reviews and clinical guidelines strongly recommend task-oriented and activity-based interventions as core components of pediatric physiotherapy for children with cerebral palsy [18, 19].

Conclusion
Task-oriented motor training is an effective physiotherapeutic intervention for improving gross motor function and balance in children with spastic diplegic cerebral palsy

Clinical Implications
- Enhances functional independence
- Improves participation in daily activities
- Cost-effective and feasible in clinical settings

Limitations
- Small sample size
- Absence of control group
- Short-term follow-up

Future Recommendations
- Randomized controlled trials
- Long-term follow-up studies

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