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Effectiveness of Task-Oriented Training in Improving Gait in a Child with Ataxic Cerebral Palsy: A Case Report

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Abstract

This case report examines the impact of task-oriented training on gait improvement in a child with Ataxic Cerebral Palsy (CP), a rare subtype characterized by balance and coordination difficulties. The goal was to determine the effectiveness of this intervention in enhancing gait stability, motor coordination, and overall mobility. A 6-year-old boy with Ataxic CP underwent task-oriented training for five days per week over a four-week period. Each session lasted one hour and included lower limb strengthening, coordination exercises, stretching, and walking practice. The Holden Gait Scale (HG) and Gross Motor Function Measure (GMFM) were used to evaluate changes in the child's gait and motor function pre- and post-intervention. After one week of therapy, the child demonstrated reduced tremors and attempted to climb stairs independently. By the end of the four-week period, the child was able to walk approximately 200 meters indoors without displaying a high-guard posture, although supervision was still required when navigating stairs. Improvements in gait stability and balance were observed, though the scissor gait persisted. Task-oriented training proved to be an effective approach in improving gait stability and motor coordination in a child with Ataxic CP. However, challenges such as upper limb high guarding and scissor gait remained, indicating the need for further personalized rehabilitation strategies. Future research should focus on integrated interventions to address these residual issues and enhance the long-term outcomes for children with Ataxic CP.

Keywords: *Ataxic Cerebral Palsy, Task-oriented training, Gait improvement, Motor coordination, Rehabilitation*

INTRODUCTION

Cerebral Palsy (CP) is a condition characterized by permanent motor and posture impairments resulting from non-progressive brain damage before, during, or shortly after birth. It includes various movement disorders caused by damage to the central nervous system, and its subtypes are classified based on the location and extent of the damage. The most common subtypes include spastic, athetoid, and ataxic CP (Bax et al., 2005; Patel et al., 2020).

Ataxic Cerebral Palsy (Ataxic CP) is a relatively rare subtype, accounting for approximately 5-10% of all CP cases. It primarily results from cerebellar damage, leading to difficulties in balance and coordination (Himmelmann & Uvebrant, 2011). Since the cerebellum is essential for fine motor control and balance, damage in this area results in movement inaccuracy, irregular motor patterns, and unstable gait (Graham et al., 2016).

Several studies have examined rehabilitation strategies aimed at improving motor function in children with CP. Task-oriented training has emerged as a promising approach for improving gait and balance. Huang & Fetters (2013) conducted a systematic review and meta-analysis that demonstrated significant improvements in walking speed and gait patterns in children with CP who underwent task-oriented training. Similarly, Grecco et al. (2014) compared treadmill training with overground walking in children with CP, reporting positive effects on balance and gait stability.

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Despite these advances, specific challenges remain, particularly in the case of Ataxic CP. Children with Ataxic CP often present with motor incoordination, balance difficulties, and a unique set of physical challenges, including wide-based gait and unsteady movement. Addressing these challenges requires more individualized rehabilitation approaches. However, studies suggest that task-oriented training is effective in improving motor outcomes, particularly by focusing on functional tasks used in everyday life (Ferrari et al., 2012; Rackauskaite et al., 2016).

This study aims to investigate the impact of task-oriented training on gait in children with Ataxic CP, further contributing to the growing body of research and offering insights into more effective rehabilitation methods.

METHODS

Study Design

The study was a single-subject case report focusing on the effects of task-oriented training on gait improvement. The intervention took place over four weeks, with five sessions per week. Each session lasted one hour and included a combination of task-oriented training and stretching exercises designed to improve lower limb strength, balance, and coordination.

Participants

This study involved a 6-year-old boy diagnosed with Ataxic CP. The child was selected based on his diagnosis of developmental delay, noticeable unsteady gait, and difficulties with motor coordination tasks, such as walking and grasping objects. He exhibited characteristic symptoms of Ataxic CP, including swaying when walking, scissor gait, and a high-guard posture of the upper limbs during ambulation. The child had no other significant medical history and passed cognitive listening tests with no abnormal results. The child had no trouble sitting, standing, or walking independently, but exhibited swaying and used strong internal rotators and adductors while walking, resulting in a scissor gait. The upper extremities displayed a "high guarding" posture while walking. Modified Ashworth Scale scores for all limbs were 0, indicating no spasticity, but the child's muscle strength was reduced, especially in muscles that resisted gravity, scoring 3/5. Babinski reflex was negative.

Intervention Protocol

The task-oriented training was designed to replicate functional tasks that the child might encounter in daily life. The intervention included the following components:

Lower Limb Strengthening: Exercises targeted the lower limb muscles to improve the child's ability to support his body weight during ambulation. Activities included standing exercises and trunk control while in a standing posture.

Coordination and Balance Training: The child practiced tasks like ring tossing, which required coordination and fine motor control. These tasks were designed to improve the child's ability to aim and control movements.

Stretching: Stretching exercises focused on the adductor and internal rotator muscles to address the child's scissor gait. Passive and active stretching techniques were used to increase flexibility and reduce abnormal gait patterns.

Walking Practice: The child was encouraged to practice walking over short distances without support, focusing on reducing upper limb guarding and improving step coordination.

Outcome Measures

Two assessment tools were used to measure the effects of the intervention:

Holden Gait Scale: This scale was used to assess the child's overall gait function. The child's ability to walk independently, maintain balance, and perform functional walking tasks was evaluated.

Gross Motor Function Measure (GMFM): The GMFM assessment tool was used to evaluate the child's motor function improvements. The assessment focused on the child's ability to control movements, maintain posture, and coordinate tasks.

Procedure

The child participated in the task-oriented training for four weeks, and his progress was evaluated weekly. In addition to regular walking practice, lower limb and balance exercises were incorporated to target specific impairments observed during the initial assessment. Each session was conducted under the supervision of a trained physical therapist. The therapist provided guidance, ensured proper execution of tasks, and adjusted the difficulty level of the exercises as the child showed improvements.

At the end of the four-week intervention, a final evaluation was conducted using the HG and GMFM assessment tools. Improvements in gait, coordination, and balance were recorded and analyzed.

DATA ANALYSIS

The child's progress was documented throughout the intervention. Descriptive statistics were used to compare pre- and post-intervention performance on the Holden Gait Scale and GMFM. The primary focus of the analysis was on improvements in gait stability, reduction in tremors, and the extent to which the child was able to walk independently. Additionally, qualitative observations on the child's motor control and coordination were noted to complement the quantitative findings.

RESULTS

The patient underwent task-oriented training and stretching therapy for five days a week, one hour per session, focusing on strengthening the lower limbs, controlling the trunk while standing, aiming for targets, stretching the adductor and internal rotator muscles, and performing coordination exercises like ring tossing. The patient's walking ability was evaluated using the Holden Gait Scale (HG) and the GMFM assessment tool.

After one week of therapy, the patient showed reduced tremors while walking independently and began attempting to climb stairs one step at a time. However, the high guarding posture of the upper limbs and the scissor gait remained. After four weeks of therapy, at discharge, the patient could walk approximately 200 meters indoors without exhibiting high guarding, though he still required supervision when climbing stairs, as he needed to hold onto the handrail and ascend one step at a time.

DISCUSSION

This case report suggests that task-oriented training is an effective rehabilitation approach for children with Ataxic CP. The intervention led to noticeable improvements in gait stability and motor coordination, which are often challenging for children with Ataxic CP. These results align with previous research that demonstrates the positive effects of task-oriented training on motor function and walking ability in children with various types of CP (Huang & Fetters, 2013; Grecco et al., 2014).

Task-oriented training emphasizes functional tasks used in daily life, making it a practical approach for rehabilitation. By focusing on real-world movements, such as walking and coordination exercises, this method addresses both physical and functional goals. This aligns with the findings of Westcott et al. (1997), who emphasized the importance of using functional, real-life activities in the rehabilitation of children with CP to enhance generalizability and daily functioning. The child in this case demonstrated reduced tremors, improved balance, and increased walking distance after four weeks of therapy, further supporting the efficacy of this approach.

However, some issues remained unresolved. The child continued to exhibit a scissor gait and upper limb high guarding, despite improvements in other areas. These persistent motor control issues may indicate that task-oriented training alone is insufficient to address all aspects of motor dysfunction in Ataxic CP. Research by

Ferrari et al. (2012) similarly observed that while task-oriented interventions improve gross motor functions, specific movement patterns such as scissor gait may require more targeted interventions, such as neurodevelopmental therapy or orthotic devices.

Upper limb dysfunction, including high guarding, also persisted post-treatment, highlighting the need for a more integrated approach. Studies by Koenig et al. (2016) and Chen et al. (2020) suggest that upper limb movement control in children with CP requires focused interventions such as constraint-induced movement therapy (CIMT) or bimanual training, which could complement task-oriented training. Including these methods in future interventions may lead to more comprehensive improvements in motor function.

Additionally, while the child demonstrated significant progress in walking indoors, difficulties remained when navigating stairs. This points to the importance of addressing environmental factors and task variability in rehabilitation. According to Shumway-Cook and Woollacott (2017), successful motor control requires the ability to adapt to changing environmental conditions, a challenge that may need more explicit practice in variable settings, such as outdoor walking or uneven terrain.

Future research should focus on developing more personalized rehabilitation strategies that combine task-oriented training with other therapeutic interventions, such as proprioceptive training, virtual reality-based rehabilitation, or robot-assisted gait training. Studies have shown that multimodal approaches can be effective in addressing complex motor deficits in children with CP, leading to more lasting improvements (Patel et al., 2020; Huang et al., 2013).

CONCLUSION

In conclusion, while task-oriented training significantly improved gait stability and motor coordination in this case, persistent issues such as scissor gait and upper limb dysfunction highlight the need for more integrated and individualized rehabilitation approaches. Collaboration among physiotherapists, occupational therapists, and other rehabilitation professionals is essential to optimize outcomes for children with Ataxic CP. Further research is needed to explore how combining various therapeutic modalities can provide a more comprehensive solution to the motor challenges faced by these children.

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