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Impact of Occupational Therapy on Fine Motor Skills Development of Cerebral Palsy Children

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Abstract

Background: *Deficits in fine motor skills typically co-occur with cerebral palsy (CP), a neurological disorder that affects movement and posture. Occupational therapy is crucial for treating cerebral palsy in children and improving their capacity for independent living. This thorough summary identifies areas that require more research and highlights the most recent advancements in cerebral palsy.* ***Aim:*** *The purpose of this review is to investigate the effects of occupational therapy treatments on the development of fine motor skills in children who have cerebral palsy.* ***Methodology:*** *Numerous research on occupational therapy interventions for children with cerebral palsy were examined as part of an extensive assessment of the literature. The review concentrated on several intervention strategies: task-specific training, constraint-induced movement therapy, and sensory integration. Analysis was also done on variables affecting the results of the intervention, including the child's age, the severity of their CP, and the length of their therapy.* ***Results:*** *The analysis revealed that treatments for occupational therapy considerably enhance children with cerebral palsy's fine motor abilities. Task-specific training, constraint-induced movement therapy, and sensory integration all showed promising results. The child's age, the severity of their cerebral palsy, and the length of their therapy all affected how beneficial these therapies were.* ***Conclusion:*** *Interventions in occupational therapy can help children with cerebral palsy develop their fine motor abilities. The child's age, the severity of the ailment, and the length of therapy all impact the intervention's choice and efficacy.* ***Implications:*** *The results offer insightful information on occupational therapy best practices, indicating that customized therapies considering unique patient characteristics can maximize the improvement of fine motor abilities in kids with cerebral palsy. To optimize therapy outcomes, therapists can use these insights to help them choose and tailor therapies.*

Keywords: Fine motor skills, Cerebral palsy (CP), Occupational therapy, Intervention strategies, Task-specific training.

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INTRODUCTION

Background

A collection of long-term mobility problems that first manifest in early childhood is known as cerebral palsy (CP). Individual differences exist in the symptoms, including tremors, weak or tight muscles, and impaired coordination. Additionally, issues with feeling, seeing, hearing, swallowing, and speaking may arise. A brain injury or aberrant development, generally occurring before birth, is the cause of cerebral palsy.

Impact on Fine and Gross Motor Skills:

The fine motor abilities of children with cerebral palsy (CP) are frequently severely compromised, making it difficult for them to do tasks like writing,

buttoning garments, and using utensils that call for little muscle movements (Veruggio, G., 2022) [27]. A child's capacity for independence in everyday tasks can be severely restricted by fine motor impairments, which can also have an impact on the child's social and educational development (Gonzalez-Mantilla et al, 2023) [7]. Gross Motor Skills, movements like walking, running, and leaping require the use of bigger muscle groups. According to Başaran, A. et al., 2023 [2]; children with cerebral palsy frequently show delays in attaining motor milestones and may need assistive aids for movement. Gross motor deficits can range in intensity from moderate, requiring little assistance, to severe, necessitating full-time care and the inability for a kid to walk. (Floor, A. P. P., 2020) [6]. Children with CP require occupational therapy to improve their fine motor abilities. Therapists employ customized exercises to improve motor function and encourage independence in everyday activities. (Dobkin, B. H., 2017) [5]. A multidisciplinary approach is frequently necessary for effective care, and it may include speech and physical therapy as well as occasionally surgical procedures to treat certain neurological deficits.

Significance of Study

Children with cerebral palsy may carry out everyday tasks like eating, dressing, and writing with greater independence when their fine motor abilities improve. Their quality of life and sense of self-worth depend on this independence (Sarvimäki, A. et al., 2000) [23]. Success in school and the workplace depends on having good fine motor skills. Youngsters who possess stronger fine motor abilities can contribute more successfully in the classroom and on future work projects, improving their performance in all aspects of their careers (Paul, 2022) [21]. The integration of cognitive and sensory processes is frequently needed for fine motor actions. Activities that improve fine motor skills can also improve cognitive development and sensory processing—areas that children with cerebral palsy sometimes struggle with. (Morgan and colleagues, 2016) [25]. Kids with strong fine motor abilities can engage in social and recreational activities to a greater extent, which enhances their relationships with peers and their social interactions (Majnemer, A. et al., 2008) [14]. By emphasizing fine motor skills, occupational therapy can improve functional abilities and lessen the degree of motor impairments. For children with CP, this therapy intervention is essential for the long-term management and rehabilitation of motor functioning.

OBJECTIVES OF THE REVIEW

1. To investigate the connection between challenging births and cerebral palsy (CP), considering the possible causes, clinical manifestations, diagnostic procedures, available treatments, and potential legal ramifications.
2. To examine the effects of fine motor abilities on everyday tasks for individuals with cerebral palsy and assess the functional implications.
3. To understand the role that prenatal variable, play in complicated births and the physiological causes of cerebral palsy.
4. To examine the current developments in CP treatment approaches, paying particular attention to their results and effectiveness.

METHODOLOGY

To find pertinent systematic reviews and meta-analyses published in English within the last ten years, the methodology involved searching automated databases like Google Scholar, Shodhganga, PubMed, Medline, and PsycINFO using keywords like fine motor skills, cerebral palsy (CP), occupational therapy, intervention strategies, and task-specific training.

Inclusion Criteria

1. Studies that concentrate on cerebral palsy in kids.
2. Research that assesses the consequences of treatments in occupational therapy.
3. Studies that quantify the progression of fine motor abilities outcomes.
4. Papers with peer review that are written in English.
5. Research works released in the previous 10 years.

Exclusion Criteria

1. Research that doesn't particularly target kids with cerebral palsy.
2. Research not assessing therapies in occupational therapy.
3. Research unrelated to fine motor skills, such as gross motor skills.
4. Papers that are not available in English.
5. Studies have a publication date that is unclear or more than 10 years old.

RESEARCH GAPS

Treatments with Multiple Tiers in School-Based Occupational Therapy (SBOT):

To improve school inclusion, multitiered SBOT therapies are desperately needed. The available literature indicates that to effectively guide SBOT implementation, more comprehensive research on individual-tier interventions is necessary.

Evaluation of Long-Term Effects

It takes a thorough evaluation of long-term consequences to comprehend the long-term implications of occupational therapy interventions on quality of life. Performing excellent follow-up studies that precisely specify how treatments result in long-lasting results is one challenge.

Interventions with a Caregiver Focus

Effective therapies for caretakers of people with cerebral palsy are lacking in research, especially when it comes to home-based settings. Research into home-based solutions to help caregivers and dyadic treatment is needed.

Increasing Occupational Therapy's Effectiveness and Impact

To improve the overall effectiveness and impact of occupational therapy programs, further research is required.

These gaps highlight how critical it is to advance occupational therapy research to enhance results in a variety of contexts, including educational settings, long-term quality-of-life evaluations, and caregiver support techniques.

FINDINGS FROM THE PREVIOUS RESEARCH

Role of Occupational Therapy in Addressing Fine Motor Skills Deficits

Occupational therapy programs have significantly enhanced the fine motor skills of children with cerebral palsy. Home programs helped children undergoing occupational therapy achieve their goals and improve their functional abilities and upper extremity skills (Novak, 2007) [16]. Poor handwriting, frequently associated with fine motor deficiencies, can affect a range of scholastic skills. Handwriting remediation is a common intervention provided by occupational therapists (OTs). Piller and Torrez (2019) [22] provided data supporting the most successful intervention strategies employed by occupational therapists, though the precise role of OTs in therapy sessions has not yet been fully determined or proven successful.

To investigate and characterize the interventions utilized by occupational therapists in treating fine motor skills related to handwriting issues, a preliminary feasibility study employed a text-mining approach. O'Mara-Eves et al. (2015) [17] conducted a retrospective analysis of 157 participants, dividing data into therapy interventions using five previously established treatment categories. The results indicated three main therapy approaches—motor and multisensory—for treating handwriting issues. Pretest and post-test results showed a considerable shift, with evidence-based therapies leading to notable improvements in fine motor abilities. However, the study's limitations included a small and single-site sample and the lack of a direct evaluation of handwriting outcomes. Future investigations might broaden the scope to include more sites and further explore the connections between treatments and results [24].

Occupational therapy is essential for treating fine motor skill deficiencies, particularly in cases such as stroke (Ma & Trombly, 2002) [26]. Previous research demonstrated a comprehensive approach from theoretical underpinnings to practical therapies, emphasizing the role of occupational therapists in assessing and treating fine motor deficits following stroke. Improving skillful motor movements is the main goal of occupational therapy, with perceptual-motor skills like eye-hand coordination being crucial for activities requiring dexterity and object handling. Lee et al. (2021) found that individuals with chronic stroke could improve their fine motor abilities by combining occupational therapy with treatments such as transcranial direct current stimulation (tDCS), suggesting that creative approaches can lead to better outcomes. Human-centered research for fine motor control rehabilitation after stroke in the Netherlands [13].

Recent research on the relationship between fine motor skills and occupational self-assessment in children with cerebral palsy highlighted how improved fine motor skills impact self-assessment and independence (Niazi, B. et al., 2022) [15]. These findings have significant implications for therapy, informing and improving occupational therapy practices (Kruijsen-Terpstra et al., 2016) [10].

DISCUSSION

The advantages of occupational therapy (OT) programs for kids with cerebral palsy (CP) have been shown in numerous research. Studies show that OT interventions, such as occupational therapy (OT) post-selective dorsal rhizotomy (SDR), parent-based OT programs, and modified constraint-induced movement therapy (m-CIMT) with occupation-based and activity analysis, significantly improve manual abilities, stress levels, coping skills, emotional competencies, and self-care performance (O'Neill et al., 2024) [19].

These findings highlight the critical role that occupational therapy (OT) interventions play in improving children with CP's overall well-being and functional outcomes (Law et al., 2007) [11]. *Therapeutic Benefits:* Improved motor function and concentration have been demonstrated by therapies such as sensory integration therapy (SIT). Children with cerebral palsy (CP) benefit from aquatic therapies such as stand-up paddle boards (SUPAT), which enhance balance, and gross motor function, and decrease falls (Harbourne et al., 2010) [9].

Self-Care Abilities: According to Guidetti and Söderback (2001) [8], occupational therapy considerably enhances children's capacity for self-care, especially when it comes to tasks like dressing.

Holistic Development: Rehab techniques that focus on participation, physical functions, and modifications to the surrounding environment during therapy sessions are essential for enhancing the overall outcomes of children with cerebral palsy (CP) [12].

Post-SDR Therapy: Through task-specific training, cognitive strategies, and client-centered approaches, inpatient OT after selective dorsal rhizotomy enhances self-care abilities, notably in dressing tasks. According to Ohrvall et al. (2023) [18], these strategies seek to improve empowerment, goal accomplishment, performance, and satisfaction.

For people of all demographics to improve their fine motor abilities, occupational therapy is crucial:

Preschoolers: Studies have indicated that occupational therapy focused on fine motor centers enhances the fine motor skills of preschoolers with typical development (Ashori et al., 2018) [1].

Down syndrome: Children with Down syndrome benefit from a fine motor activities program that increases their bilateral hand coordination and hand muscle strength (Ashori et al., 2018) [1]. *Educational Settings:* Handwriting and fine motor issues in school-age children are addressed by interventions incorporating visual motor activities, kinesthetic training, and motor strategy development (Case-Smith,2002) [3].

After-Stroke Rehabilitation: Tailored assessment and therapy programs in occupational therapy after a stroke are very successful in helping patients restore their fine motor skills. Hand-Eye Coordination Occupational therapy, using a variety of methods, also considerably improves hand-eye coordination [4]. Hand Dexterity: Using multipurpose hand tools and real-time feedback systems enhances hand-eye coordination and manual dexterity (Patel, 2019) [20].

Exercises for the Visual-Spatial Mind: According to Zoccolotti et al. (2011) [28], intensive rehabilitation programs emphasizing visual-spatial mind exercises result in significant gains in hand-eye coordination, a decrease in task mistakes, and a reduction in coordination evaluation times.

CONCLUSION

In summary, occupational therapy interventions have a significant impact on how fine motor abilities develop in kids with cerebral palsy. Across a range of demographics, targeted therapies and programs are effective in improving fine motor skills, hand-eye coordination, and overall functional independence.

Limitations

- It might be difficult to reach consistent findings when the review encompasses research with different participant profiles, intervention kinds, and methodologies.
- The results of some research may not be as generalizable due to limited sample numbers.

Recommendations for Future Research

- Carry out extended research to see if fine motor skill benefits obtained from occupational therapy are sustainable.
- To improve the comparability of outcomes across much research, develop and implement uniform intervention procedures.
- To improve therapeutic efficacy and participation, look into occupational therapy programs.

Conflicts of Interest

The authors declared no conflict of interest.

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