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Research Article

Effect Of Sensory Integration Based Fine Motor and Gross Motor Activities on Motor Coordination in Children with Autism Spectrum Disorder

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ABSTRACT

Background: Children with Autism Spectrum Disorder (ASD) often experience challenges in motor coordination, affecting both fine and gross motor skills. Sensory integration-based activities, which involve using sensory experiences to improve motor function, have shown promise in enhancing motor coordination. This study explores the effect of sensory integration-based fine and gross motor activities on motor coordination in children with ASD, aiming to improve their functional abilities and overall quality of life.

Study design: Experimental study

Aim: To find out the effect of sensory integration based fine motor and gross motor activities in improving motor coordination in children with ASD.

Objective of the Study:

- To evaluate the effect of sensory integration based fine motor and gross motor activities in improving motor coordination in children with ASD.
- To compare the effect of sensory integration based fine motor and gross motor activities and conventional OT in improving motor coordination in children with ASD

Participants: In this study, 72 children were selected of age range 5 to 8 year diagnosed with autism spectrum disorder.

Methods: Subjects was evaluated pre-post treatment using DCDQ-07 to asses motor coordination and to identify the effect of sensory integration based fine and gross motor activities on motor coordination. Subjects were divided into two groups; group A – 36 (experimental) and group B-36 (conventional). The sensory integration-based intervention was conducted 3 sessions per week for 6 months.

Results: The study found that sensory integration-based motor activities significantly improved motor coordination in children with ASD, with the experimental group showing a notable increase in mean scores (33.03 to 41.5). Statistical analysis confirmed the improvements ($p < 0.001$), while the control group showed a smaller, less significant change, suggesting that sensory integration interventions were more effective in enhancing motor coordination.

Conclusion: The findings from this study provide compelling evidence that sensory integration based fine and gross motor activities are effective in improving motor coordination in children with autism spectrum disorder.

Keywords: Autism Spectrum disorder, Sensory integration, Fine motor, Gross motor, Motor coordination and DCDQ-07

INTRODUCTION

Autism Spectrum Disorder (ASD) encompasses a wide range of developmental conditions characterized by varying levels of impairments. These challenges include issues in sensory processing, social communication, movement, focus, and typical developmental milestones[1].

In the context of autism spectrum disorder, the term "spectrum" describes the broad range of symptoms and intensity[2]. Poor muscle tone, poor motor planning, and toe walking, perception, communication, sensory

processing and neurological dysfunctions result in various functional behavior limitations[3,4]. Dysfunctions in sensory processing, communication, and the nervous system contribute to various functional limitations in individuals with ASD[5].

Sensory integration refers to the process by which the brain receives, organizes, and responds to sensory input from the environment[6].

Children with sensory processing difficulties may struggle with tasks that require coordinated motor responses and appropriate behavior. Sensory integration dysfunction can manifest in different ways, such as overreacting or under reacting to sensory stimuli, difficulty coordinating movement, or challenges with attention and self-regulation (Miller et al., 2007)[7].

Motor coordination has a crucial role in various physical activities and sports, highlighting its significance in overall movement proficiency and performance[8].

Sensory integration and motor skills are interconnected processes. Proper sensory processing allows children to develop motor skills, as they must be able to sense their environment to control their bodies and perform movements[9].

Children need these skills not only for everyday tasks like eating, buttoning clothes, and handling small objects, but also for learning activities like writing, sketching, and computer keyboarding. Math and textual expression are influenced by fine motor skills. Children with developmental coordination deficit, hemiplegic cerebral palsy, obesity, and autism spectrum disorder have been observed to have poor fine motor abilities[10].

The relationship between sensory integration, fine motor, and gross motor skills is a critical aspect of child development. Sensory processing is essential for motor coordination, and difficulties in sensory integration can lead to delays in both fine and gross motor skill development. Through targeted interventions, such as sensory integration therapy and motor skills training, children can improve their ability to process sensory input and develop the motor skills necessary for daily activities and social participation.[10]

Despite extensive research exploring various interventions for children with autism spectrum disorder (ASD), the efficacy of sensory integration-based approaches remains a key area of investigation. The integration of fine and gross motor activities targeting sensory processing dysfunction is crucial for enhancing motor coordination, which can significantly impact children's ability to engage meaningfully in daily tasks. Given the unique sensory and motor challenges faced by children with ASD, it is essential to explore how structured sensory integration interventions can support motor skill development and improve functional outcomes. This study aims to evaluate the effects of sensory integration-based fine and gross motor activities on motor coordination in children with ASD, addressing a critical gap in research and aiming to contribute to evidence-based practice in pediatric occupational therapy.

METHODOLOGY

A total of 72 children participated in the study, with the sample size determined by a statistical expert to ensure sufficient power for detecting meaningful results. Data for this study was collected from three institutions: Open Arms Child Development Center (Kalkaji), Glint of Joy (Kalkaji), and Percept Rehabilitation and Child Guidance Center (Indirapuram). Participants were selected using randomized sampling through the chit method, ensuring that each child had an equal chance of being assigned to either the experimental or control group. The children were aged between 5 and 8 years and met specific diagnostic criteria for ASD. The study was conducted over 6 months, allowing for adequate observation of the interventions' effects. The method of data collection involved selecting children based on inclusion and exclusion criteria. To measure the children's motor coordination, the DCDQ-07 (Developmental Coordination Disorder Questionnaire) was used, which provided a reliable assessment tool throughout the study period.

Inclusion Criteria:

- Children diagnosed with autism spectrum disorder (ASD**)** by a psychologist.
- Children aged between 5 and 8 years.
- Both male and female children were included.

Exclusion Criteria:

- Children older than 8 years.
- Children diagnosed with other neuropsychiatric conditions.
- Children without a confirmed diagnosis of autism spectrum disorder.

The treatment protocol for the study was designed to compare two different approaches to therapy: a sensory-based intervention and conventional occupational therapy. In the experimental group, each session began with an initial 5 minutes dedicated to helping the child adjust to the environment. This was followed by 40 minutes of sensory-based fine and gross motor activities, tailored to each child’s needs, to help improve motor coordination and sensory processing abilities. The experimental group received three sessions per week over the course of 6 months. The control group, on the other hand, received conventional occupational therapy, which focused on standard interventions to improve motor skills and coordination. These sessions also lasted 45 minutes per session and were held three times a week for 6 months.

Outcome Measure:
Developmental Coordination Disorder Questionnaire (DCDQ-07)

The Developmental Coordination Disorder Questionnaire (DCDQ-07), a parent-report measure, assesses motor coordination. It consists of 15 items with a 5-point Likert scale, used to evaluate coordination in daily functional activities. The score range is 15–75. Scores from 15–46 indicate a risk or presence of developmental coordination disorder (DCD), while scores between 47–75 suggest normal motor coordination[14].

DATA COLLECTION

The DCDQ-07 was administered to all participants before and after the 6-month intervention period to assess motor coordination. Data was collected for both the experimental and control groups, with pre- and post-treatment assessments being compared.

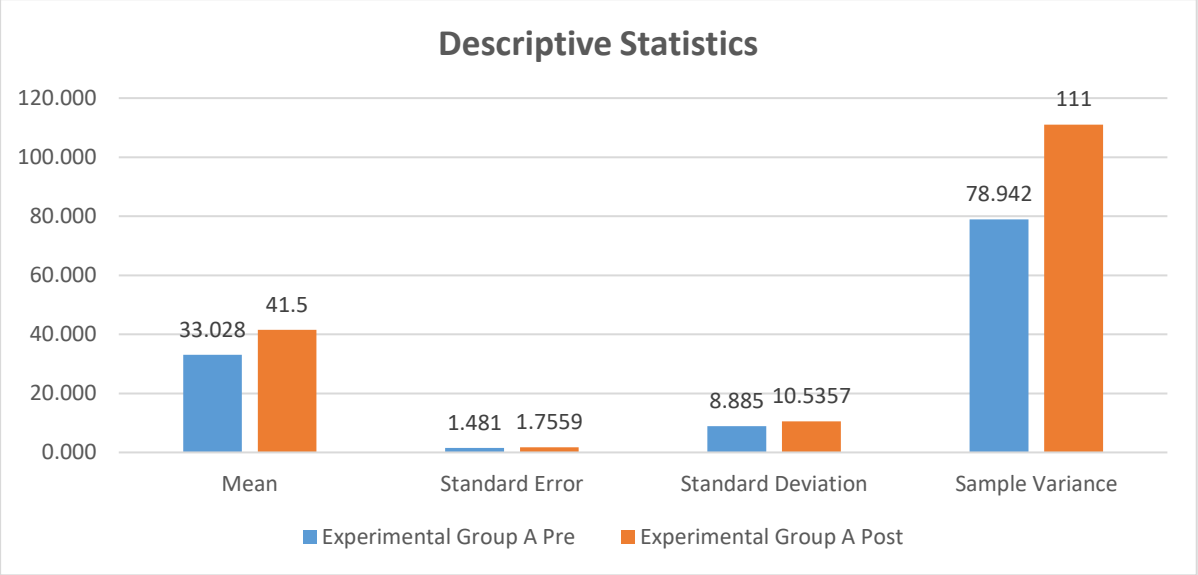
DATA ANALYSIS

Data was analyzed using IBM SPSS. Paired t-tests were conducted to compare pre-treatment and post-treatment motor coordination scores within each group.

RESULT

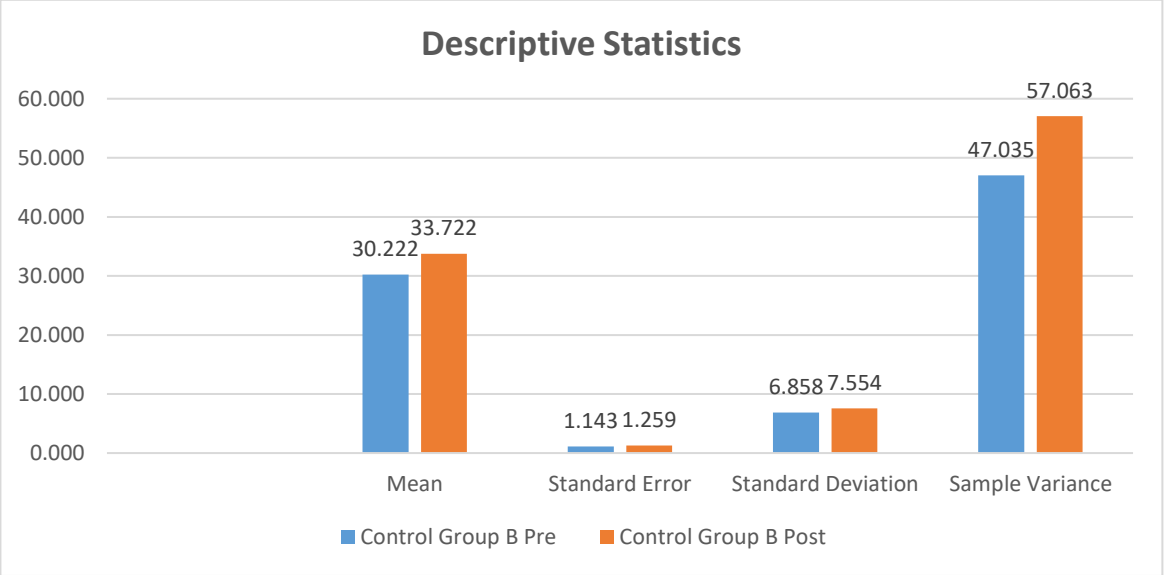
This study examined the impact of sensory integration-based fine and gross motor activities on motor coordination in children with autism spectrum disorder (ASD). The results from the experimental and control groups reveal significant improvements in motor coordination post-intervention, particularly in the experimental group.

Experimental Group:



In the experimental group, age distribution was categorized as follows: 17 children aged 5, 15 children aged 6-7, and 4 children aged above 7 years. Descriptive statistics of Experimental Group A showed an increase in the mean from 33.03 (Pre) to 41.5 (Post), indicating a significant improvement in motor coordination. The standard deviation increased from 8.885 to 10.536, indicating a greater variability in post-intervention results. Paired t-tests revealed a highly significant difference between pre- and post-intervention means ($t = 5.2166E-14$, $p < 0.001$), supporting the hypothesis that sensory integration-based activities positively affect motor coordination in children with ASD.

Control Group:



In comparison, Control Group B showed a smaller improvement, with the mean increasing from 30.22 (Pre) to 33.72 (Post). The standard deviation increased from 6.858 to 7.554, but the change was less pronounced compared to the experimental group. Paired t-tests for the control group also revealed significant improvement ($t = 2.74E-11$, $p < 0.001$), but the effect size was smaller than that of the experimental group.

Comparison Between Groups:

Comparison of t-Test between Group A and Group B

t-Test: Paired Two Sample for Means				
Stats	**Experimental Group**		**Control Group**	
	Pre	***Post***	***Pre***	***Post***
Mean	33.0278	41.5	30.222	33.722
Variance	78.9421	111	47.035	57.063
Observations	36	36	36	36
Pearson Correlation	0.91948		0.9581	
P(T<=t) two-tail	5.2166E-14		2.74E-11	
t Critical two-tail	2.03011		2.030108	

A direct comparison of the experimental and control groups revealed that the experimental group showed a more significant improvement in motor coordination. The experimental group's mean increase (8.47 units) was higher than the control group's mean increase (3.5 units). This difference, along with the Pearson correlation values (0.91948 for the experimental group and 0.9581 for the control group), confirms a strong relationship between pre- and post-intervention scores, indicating the consistency of the improvements. The statistical significance ($p < 0.001$ for both groups) supports the conclusion that the sensory integration-based activities were more effective in improving motor coordination than the activities in the control group.

These findings suggest that sensory integration-based interventions can significantly enhance motor coordination in children with ASD, making it a valuable approach for improving their physical functioning.

DISCUSSION

This study provides significant insights into the efficacy of sensory integration-based fine and gross motor activities for improving motor coordination in children with autism spectrum disorder (ASD). The experimental group demonstrated a substantial increase in motor coordination, from a pre-intervention score of 33.03 to a post-intervention score of 41.5, with statistical analysis confirming the significant difference ($p < 0.001$). In contrast, the control group showed more modest improvements, with a mean increase from 30.22 to 33.72, suggesting that sensory integration interventions have a more profound impact on motor coordination than conventional approaches.

These findings align with previous research emphasizing the role of sensory integration in improving motor coordination in children with developmental disorders. For instance, Case-Smith and Arbesman (2008) reported that sensory integration therapy enhances both fine and gross motor skills in children with ASD,

promoting participation in daily activities[13]. Similarly, Miller et al. (2012) concluded that sensory processing interventions yield positive outcomes in motor coordination, particularly in children with sensory processing disorders like ASD[7].

The control group, which did not receive the same sensory integration-based intervention, exhibited a smaller effect size and less variability in the post-intervention data, reinforcing the effectiveness of targeted sensory integration activities. Statistical significance ($p < 0.001$) for both groups indicates that although both interventions led to improvements, the sensory integration-based activities produced more consistent and reliable results in the experimental group.

These results highlight the importance of incorporating sensory integration-based interventions in therapeutic programs for children with ASD. The strong correlation between pre- and post-scores in the experimental group (Pearson correlation = 0.91948) suggests that these interventions not only improve motor coordination but also contribute to a more predictable and consistent progression in physical abilities.

CONCLUSION

This study provides strong evidence that sensory integration-based fine and gross motor activities significantly improve motor coordination in children with ASD. These interventions have the potential to improve functional abilities and overall quality of life for children with ASD.

LIMITATION

The study was limited to single neurodevelopmental disorder only

RECOMMENDATION

Future research could include children aged 9 and older to assess the efficacy of sensory integration-based activities across a broader age range. Further studies can explore the long-term effects of sensory integration interventions. Future study should include other neurodevelopmental disorders also.

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