

# Effect of Postural Training in Improving Hand Eye Coordination in Autism Children - An Interventional Study

Sumitha Hemavathy<sup>1</sup>, Ramya K<sup>2</sup>, Senthilkumar M<sup>2</sup>, Jeyanthi D S<sup>3</sup>

<sup>1</sup> Director, CAPAAR (Center for Advanced Paediatric and Adult Rehabilitation), Bengaluru, Karnataka, India

<sup>2</sup> Director, Barath Physio Care, Salem, Tamil Nadu, India.

<sup>3</sup> Director, Mithra Medical Center, Tenkasi, Tamil Nadu, India.

Corresponding author: Ramya K

DOI: <https://doi.org/10.52403/ijrr.20240320>

## ABSTRACT

Autism is one of the major developmental delays that affect the children at an early age. It presents as a series of motor and sensory impairments that constantly needs adjustment in posture. Evaluation of motor skills and enhancing it quite often results in postural adjustment. The primary objective of this current study is to investigate the effect of postural training exercises prior to administration of motor activities in improving the hand eye coordination to perform upper limb tasks. The study was a randomised control trial that included children of both sexes with a diagnosis of autism between the age group of 5 and 10. All the participants of the study underwent the pre-test assessment of Gross motor skill and fine motor skill and were entered in the data sheet as pre-test score. The children's Gross motor skill and Fine Motor Skill were assessed through Box and Block test and 25 grooved peg board test respectively. The test was performed for the dominant hand of the participant. The participants in control group underwent the motor and fine motor activities for a period of 30 minutes each session on alternate days for 8 weeks. The participants in experimental group received postural stability exercises along with these activities. At the end of 8 weeks the results of the study showed significant

improvement in the experimental group. The study concluded that postural stability exercises prior to the activities improved the motor and fine motor skill of the autism children.

**Key Words:** Autism, Postural Exercises in autism children, Hand eye coordination, Postural instability.

## INTRODUCTION

Autism is a developmental disorder that affects the children and manifests itself within the first two years of age. It is known as spectrum disorder just because it encompasses a series of disorders that are grouped either as neurological or developmental or in many cases both. Most of the times, the symptoms are with different variation and severity. It is represented as a sensory deficit or a motor delay, with difficulty in emotional adjustments and isolation. It can also be a combination of one or the other features. Early identification and treatment of autism can be beneficial both to the child and the parents.

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication and the presence of restricted interests and repetitive behaviors.[1] There is reportedly an increase in the cases of autism worldwide and also in

India. The longitudinal analysis of data across years within the same geographical area confirms the increase of prevalence estimates that has repeatedly drawn scientists' attention in the last twenty years. [2] India has seen a rise in incidence of autism children in recent years which could even be called as an epidemic irrespective of the geographical location, be it rural, urban or tribal. [3] It is suggested that the increase in prevalence of autism cases is mainly due to the increased awareness among the public and various health care programs conducted at the community level. [4] However, any effective treatment should aim to desensitize the sensory component and normalize the motor part and overcome the emotional disturbances.

It is suggested that the motor skills of autism children need to be specifically addressed in relation to posture correction along with the usual strengthening part. Examining postural control as an endophenotype or early diagnostic marker of autism is a conceptual premise that needs further thorough in-depth analysis. [5] Postural control is one of the most fundamental competencies that a child should develop, which otherwise may affect learning opportunities and other motor milestones. Thus, abnormal postural control can exacerbate ASD core symptoms by limiting social interactions. [6] The factors contributing to postural control impairments could be accounted not only to brain dysfunction, social disabilities, lack of motor experiences, environmental distraction, but also to sensory motor disintegration, developmental delay, cognitive overload, and attention problems. [7] Hence, it could be said that postural control can exacerbate the symptoms of ASD and vice versa. And it is also related to the hesitation in interacting socially with the parent, sibling, and peers. [8]

Postural stability, as the name specifies, is the ability of an individual to maintain the person's center of gravity within the given base of support. It is one of the most

primary motor skill that a child develops in early life. It is an indispensable skill to take part in any motor tasks such as drawing, playing, riding a cycle, or throwing a ball. Autism children display a variety of compensatory postural adjustments during motor activity. However, proprioceptive, vestibular, and cerebellar systems are also reported to contribute to postural sway in ASD children. The wide distribution of brain dysfunction, including abnormalities in the interconnection of different brain areas, leads to atypical movements common in persons with ASD, such as decreased motor coordination, execution of movement, postural control, and motor-sensory integration. [9] Various postural adjustments observed were antero-posterior sway, lateral sway, causing a shift in the center of pressure, forward bent posture, and flexed neck. [10]

The primary objective of this current study is to investigate the effect of postural training exercises prior to the administration of motor activities in improving hand-eye coordination to perform upper limb tasks. For school-going children, the environment itself demands prolonged sitting for hours together to excel in academic performance. In such a scenario, ASD children find it very difficult to maintain the posture and quiet, often shifting their body weight or exhibiting postural instability, which is noticed by the teacher who is in constant prompt to maintain the posture. Hence, this study aims to arrive at a specified outcome to reduce the postural instability of autism children.

## **MATERIALS AND METHODOLOGY**

The children attending the treatment sessions at CAPAAR (Center for Advanced Paediatric and Adult Rehabilitation, Hulimavu, Bengaluru) were recruited for the study after taking the consent from the parents. A clear explanation of the nature and the purpose of this study were briefed to the parents, and all the queries were clarified after which a written informed consent form was signed. A consecutive sampling method was adopted in the study. The study period was from June 2023 to November 2023. A

total of 70 participants were included in the study. However 2 participants withdrew from the study because of parents moving to another place and 3 participants were not willing to continue the study and hence were dropped off in the final analysis.

The criteria for selection were the subjects who fall between the age group of 5 and 10 years of both sexes and who were attending the treatment sessions at CAPAAR were included in the study. The subjects who had a diagnosis of autism through Autism Diagnostic Observation Schedule (ADOS-2) and who had an expert opinion of a Developmental Paediatrician based on DSM-5 criteria were alone included in the study. The participants with a history of convulsions from birth or on medications such as anticonvulsants or stimulants or on any other medications for improving motor performance were excluded from the study. Subjects with a history of head injury, mental retardation, cerebral palsy were excluded from the study. All the participants of the study underwent the pre-test assessment of Gross motor skill and fine motor skill and were entered in the data sheet as pre-test score. The children's Gross motor skill and Fine Motor Skill were assessed through Box and Block test and 25 grooved peg board test respectively. The BBT was performed for the dominant hand of the participant. It consisted of a wooden box with two compartments separated by a partition with 150 blocks. The subjects were instructed to move the maximum number of blocks into the empty space one by one within the allotted time span of 90 seconds. The number of blocks moved over the stipulated time is marked as pre-test score. The 25 grooved peg board test consists of 25 holes with slots and pegs that are positioned randomly. The subject picks a peg and inserts into any of the holes. The score is calculated in seconds. The subject has to peg all the holes within 5 minutes.

The subjects in both the groups underwent the respective treatment protocol for 4 days a week for 8 weeks. The subjects in control group received motor activities like

squeezing a sponge with water, spray bottle, punching holes in color paper, crumbling paper into a paper ball, tearing paper. This was followed by fine motor activities like putting beads into a thread, picking up a colored button and placing in same colored tray, sorting out cloth clips and pinning it into the paper, sorting rajma, joining dots in a paper. The total time for all these activities lasted for 30 minutes. All the activities were initially demonstrated by the researcher. As the subjects performed the task verbal prompting and visual cues were given. In case any of the subject was not able to remember the task, the researcher performed the task once again or guided the action. The subjects in experimental group received postural correction exercises prior to all these activities. The postural correction exercises mainly aimed at stabilizing the scapula and cervical spine for performing these activities in sitting position. These included prone lying push ups, quadripod kneeling, shoulder bracing, chin tucking. After these exercises the motor and fine motor activities were given as in control group. At the end of 8 weeks a post test was done.

## STATISTICAL ANALYSIS

The statistical analysis was performed using SPSS software version 25. A confidence interval of 95% and a significance of 0.05 was fixed. The within group analysis was done through ANOVA and between group analysis was done using independent t-test.

## RESULTS

A total of 65 subjects were accounted for the study. The demographic data of the participants are presented in table 1. The within group and between group analysis of Box and Block test and 25 grooved peg test are presented in table 2 and 3. The results showed that there was a significant difference in Box and Block test with a mean of  $42.1 \pm 4.0$  blocks in control group whereas the experimental group had a mean of  $52.2 \pm 4.6$  blocks. The 25 grooved peg test showed a significant difference of  $30.8 \pm$

4.2 pegs in control group and  $34.6 \pm 5.2$  pegs in experimental group.

**Table 1 – Demographic data**

	Control Group		Experimental Group	
	Mean	SD	Mean	SD
Age	7.6875	2.464	7.7642	2.317
Gender	Male	Female	Male	Female
	14	18	15	18
Height in cms	138.2		139.7	
Weight in kgs	38.2		37.9	

**Table 2 – Within group Analysis**

Variables	Group	F value	P value
Box & Block Test	Control Pre & Post	190.1	0.05
	Exp Pre & Post	10.44	0.05
25 grooved peg test	Control Pre & Post	380.7	0.003
	Exp Pre & Post	1382.4	0.008

**Table 3 – Between group Analysis**

Variables	Group	t value	P value
Box & Block Test	Control & Exp Pre	12.23	0.03
	Control & Exp Post	15.73	0.05
25 grooved peg test	Control & Exp Pre	10.72	0.02
	Control & Exp Post	12.08	0.05

## DISCUSSION

The purpose of this study is to investigate the effect of postural training exercises prior to administration of gross motor and fine motor activities in improving the hand eye coordination to perform upper limb tasks. Postural instability is the most exhibited in autism children. Because of this instability there is lack of hand eye coordination in performing most of the upper limb tasks was identified as a paradigm in rehabilitating the autism children.[11] It was also identified that because of this lag in correcting the posture most of the parents had to spend more money on the treatment sessions which were turning futile due to repetitive tasks which were boring for the children.[12] Identification of a treatment strategy to reduce or overcome this postural instability will be beneficial to the children in performing the motor tasks and achieving the milestones in a short duration. Postural instability has been positively correlated with poor hand eye coordination.[13] This study identified that the administration of postural exercises prior to activities to train gross motor and fine motor component helped the children in focussing on the tasks and executing it better in time and speed in comparison with the subjects who received

only the activities training. This is in accordance with a study that identified when the spinal extensors are recruited, they show a lessened postural sway and improve the usage of hand in autism children.[14]

## CONCLUSION

The study concluded suggesting incorporation of postural exercises prior to any of the activities to improve motor skills in autistic children.

### Declaration by Authors

**Ethical Approval:** Approved

**Acknowledgement:** The authors express their gratitude to all the participants and their parents for participating in the study.

**Source of Funding:** None

**Conflict of Interest:** The authors declare no conflict of interest.

## REFERENCES

- Hodges H, Fealko C, Soares N. Autism spectrum disorder: definition, epidemiology, causes, and clinical evaluation. *Translational pediatrics*. 2020 Feb;9(Suppl 1):S55.
- Fombonne E. Epidemiological controversies in autism. *Swiss Archives of Neurology, Psychiatry and Psychotherapy*. 2020 Jan 28;171(01).
- Raina SK, Chander V, Bhardwaj AK, Kumar D, Sharma S, Kashyap V, Singh M, Bhardwaj A. Prevalence of autism spectrum disorder among rural, urban, and tribal children (1–10 years of age). *Journal of neurosciences in rural practice*. 2017 Jul;8(03):368-74.
- Kyvelidou A, DeVeney S, Katsavelis D. Development of Infant Sitting Postural Control in Three Groups of Infants at Various Risk Levels for Autism Spectrum Disorder. *International journal of environmental research and public health*. 2023 Jan 10;20(2):1234.
- Memari AH, Ghanouni P, Shayestehfar M, Ghaheri B. Postural control impairments in individuals with autism spectrum disorder: a critical review of current literature. *Asian journal of sports medicine*. 2014 Sep;5(3).
- Travers BG, Powell PS, Klinger LG, Klinger MR. Motor difficulties in autism spectrum disorder: linking symptom

- severity and postural stability. *Journal of autism and developmental disorders*. 2013 Jul;43:1568-83.
7. Dziuk MA, Larson JG, Apostu A, Mahone EM, Denckla MB, Mostofsky SH. Dyspraxia in autism: association with motor, social, and communicative deficits. *Developmental Medicine & Child Neurology*. 2007 Oct;49(10):734-9.
  8. Kohen-Raz R, Volkman FR, Cohen DJ. Postural control in children with autism. *Journal of autism and developmental disorders*. 1992 Sep;22(3):419-32.
  9. Fournier KA, Kimberg CI, Radonovich KJ, Tillman MD, Chow JW, Lewis MH, Bodfish JW, Hass CJ. Decreased static and dynamic postural control in children with autism spectrum disorders. *Gait & posture*. 2010 May 1;32(1):6-9.
  10. Funahashi Y, Karashima C, Hoshiyama M. Compensatory postural sway while seated posture during tasks in children with autism spectrum disorder. *Occupational therapy international*. 2014 Dec;21(4):166-75.
  11. Crippa A, Forti S, Perego P, Molteni M. Eye-hand coordination in children with high functioning autism and Asperger's disorder using a gap-overlap paradigm. *Journal of autism and developmental disorders*. 2013 Apr;43:841-50.
  12. Shapi'i A, Abd Rahman NA, Baharuddin MS, Yaakub MR. Interactive games using hand-eye coordination method for autistic children therapy. *Int. J. Adv. Sci. Eng. Inf. Technol*. 2018;8(4-2):1381-6.
  13. Delaherche E, Chetouani M, Bigouret F, Xavier J, Plaza M, Cohen D. Assessment of the communicative and coordination skills of children with autism spectrum disorders and typically developing children using social signal processing. *Research in Autism Spectrum Disorders*. 2013 Jun 1;7(6):741-56.
  14. Bucci MP, Goulème N, Dehouck D, Stordeur C, Acquaviva E, Septier M, Lefebvre A, Gerard CL, Peyre H, Delorme R. Interactions between eye movements and posture in children with neurodevelopmental disorders. *International Journal of Developmental Neuroscience*. 2018 Dec 1;71:61-7.

How to cite this article: Sumitha Hemavathy, Ramya K, Senthilkumar M, Jeyanthi D S. Effect of postural training in improving hand eye coordination in autism children – an interventional study. *International Journal of Research and Review*. 2024; 11(3): 151-155. DOI: <https://doi.org/10.52403/ijrr.20240320>

\*\*\*\*\*