

**Research Article****Effect of Ball Throw and Catch Game on balance and co-ordination in children with Cerebral Palsy****Dr SANJANA SONI<sup>1</sup>, Dr NIDHI SUTHAR<sup>2</sup>**<sup>1</sup>First Year MPT (Neurosciences) student, <sup>2</sup>Assistant Professor, JG College of Physiotherapy, Ahmedabad, Gujarat**Corresponding Author: Dr Sanjana Soni****Abstract**

Introduction: Cerebral Palsy is a permanent but not unchanging neurodevelopmental impairment caused by a non-progressive defect or lesion in single or multiple locations in the immature brain. Objective: This study aims to evaluate the effect of ball throw and catch game technique on balance and co-ordination in cerebral palsy children. Method: This study was conducted on n =24. Patients were divided into two groups: experimental and control group. The treatment programmes of both groups were conducted 5 days a week for 2 weeks. Both tests were assessed before 1<sup>st</sup> session and at the end of 10<sup>th</sup> session. Result: SPSS version 20 was used for data analysis. Paired-t test was used within the group analysis and unpaired t-test was used between the group analysis where t values between groups t= 6.794 in balance and t=2.803 in co-ordination respectively with level of significance found to be p=0.017 for balance and p=0.010 for co-ordination. Conclusion: This study suggests that playing throw and catch game can enhance balance and coordination in children with cerebral palsy.

**Keywords:** Cerebral palsy, Pediatric Balance Scale, Comprehensive Co-ordination Scale, balance**Introduction**

Cerebral Palsy describes a group of disorders of the development of movement and posture, causing limitations in daily living which are attributed to non-progressive disturbances that occurred in development of fetal or infant brain. Cerebral Palsy affected children have primary or secondary disorders in the muscular, bone, and joint systems which results in impaired coordination, communication, adaptation, mobility, balance and disruption of personal needs.<sup>1</sup> It is a permanent but not unchanging neurodevelopmental impairment caused by a non progressive defect or lesion in single or multiple locations in the immature brain.<sup>2,3</sup>

Worldwide incidence of CP is 2 to 2.5 per 1000 live births while in India it is 2-4 per 1000 live birth.<sup>3</sup> Risk factors and conditions that can combine into pathways to CP include genetic variants, congenital anomalies, preterm birth, intrauterine growth restriction and infection, hypoxic ischaemia and cerebrovascular insults during pregnancy and in infancy, and brain injury.<sup>4</sup>

Cerebral palsy is classified into spastic, dyskinetic and movement disorders, ataxic and hypotonic.<sup>5</sup> Many children have also been presented with mixed type of CP, who does not fit into any of the above classification but have characteristics of more than one type of CP. From the previous studies conducted in India it has been found that spastic quadriplegia constituted 61% of cases and that of diplegia in 22%.<sup>5,6,7</sup>

Cerebral palsy may affect the child on several health dimensions; the motor signs include primary neuromuscular deficits, such as spasticity, muscle weakness, imbalance and decreased selective motor control and secondary musculoskeletal problems such as bony malformations and contractures.<sup>8</sup> The nature and severity of the disturbance in motor function varies greatly in children with CP.<sup>9</sup>

Complex sensorimotor coordination of eye, hand and trunk is required for grasping any objects and in children affected by CP all these systems are individually affected which can also interfere with development of individual life skills. A child with cerebral palsy can have a non-progressive motoric abnormality caused by imperfect development and damage in one or several parts affects brain control and motoric activity, especially motion. The risk factor of cerebral palsy can happen before and during pregnancy, labour, birth, and also after birth.<sup>9,10</sup>

Deficits in the visual, somatosensory, and vestibular systems, needed to guarantee postural control, have been observed in children with CP, causing distorted balance, and causing difficulties in maintaining balance during activities of daily living and restricting participation in social life domains. Physical therapy often includes balance training in their therapy sessions to improve their gross motor ability.<sup>11</sup>

Pediatric Balance Scale (ICC = 0.99) has been found useful for assessing functional balance in preschoolers and school-aged children with CP.<sup>11</sup> The purpose of PBS is to examine functional balance in the context of daily life's activities in the pediatric population. It contains functional measured items, which are sitting to standing, standing unsupported, standing to sitting, sitting unsupported, transfer standing with eyes closed, standing with feet together, standing with one foot in front, standing on one foot, turning 360°, turning to look behind, retrieving object from floor, placing alternate foot on stool and reaching forward with outstretched arm. The score level of each item will be recorded on a five-point liker scale (from 0 to 4), depending on the quality of performance. Total score ranged from 0 to 56. Higher score indicates better functional balance ability.<sup>12</sup>

Coordinated movements are defined as movement of one or more limbs or body segments that occur together in identifiable temporal and spatial patterns, concerning the desired action. The Comprehensive Coordination Scale (ICC = 0.98) is a measure of coordination of multiple body segments at both motor performance and quality of movement levels based on observational kinematics.<sup>13</sup>

### **Aim**

This study briefly aims to evaluate the effect of ball throw and catch game on balance and coordination in cerebral palsy children.

### **OBJECTIVE**

This study evaluates the effect of ball throw and catch game technique on balance and coordination in cerebral palsy children.

### **METHODOLOGY**

A convenient experimental study was undertaken among college students. Ethical Clearance has been taken from The Ethical Committee of The Institute. The study recruited those who were willing to participate and between the ages of 5 and 12. A total of 24 students completed the study and were included in the analysis. All the parents were explained about the study and consent was taken for those who were agreed for participating in the study. Participants were divided into 2 equal groups experimental and control group. Pediatric Balance Scale and Comprehensive Co-ordination Scale were taken pre and post intervention.

The duration of the study was 10 days, during which 24 subjects participated in the study. Subjects were divided randomly into 2 groups of 12 each. Group A (experimental group) followed the ball catch and throw game with conventional therapy whereas Group B (control

group) followed conventional therapy only. In addition to the previous program, the children received the following exercises:

- a. Stretching exercises for shortened muscles.
- b. Strengthening exercises for weak muscles.
- c. Balance exercises on balance board.

### **Inclusion Criteria**

Children who were aged 5-12 years age, were able to stand independently and were able to walk independently with or without an assistive device. The children who were at level I and II on Gross Motor Function Classification System (GMFCS) and able to follow instructions during evaluation and treatment procedures.

### **Exclusion Criteria**

Children having uncorrected vision or hearing impairments, uncontrolled seizures and lack of mid-line activity. Children having fractures of upper and lower limbs. Received botulinum toxin in the lower extremity musculature during the past 6 months.



### **Study Design**

A study was included in the review when it met all the inclusion criteria:

1. Experimental studies
2. Studies including participants with CP between the age of 5-12 years old
3. Studies where the intervention group received ball throw and catch game in their daily therapy sessions
4. Studies with a comparison group that received their physical therapy
5. Studies that assessed balance and co-ordination
6. Studies with quantitative data (mean and standard deviations) to perform the study.\

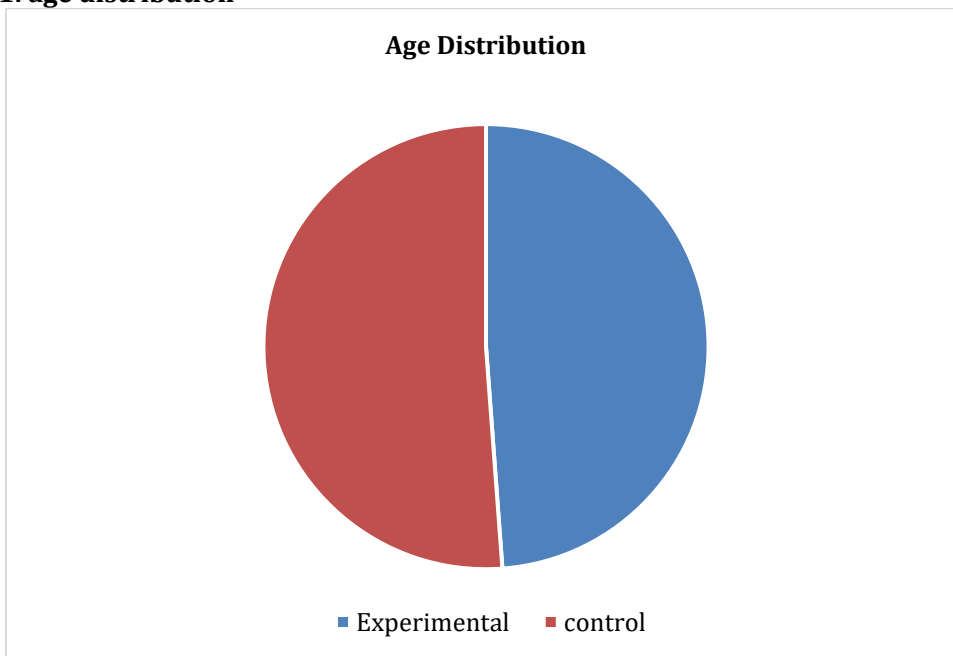
### **RESULT**

SPSS version 20 was used for data analysis. Data normality was checked using Kolmogorov-Smirnov test. Paired-t test was used within the group analysis and unpaired t-test was used between the group analysis where t values between groups  $t= 6.794$  in balance and  $t=2.803$  in co-ordination respectively with level of significance found to be  $p=0.017$  for balance and  $p=0.010$  for co-ordination.

**TABLE 1.1: AGE DISTRIBUTION**

Groups	No. of subjects	Mean age	SD
experimental	12	6.916667	2.0226
control	12	7.230769	2.127355

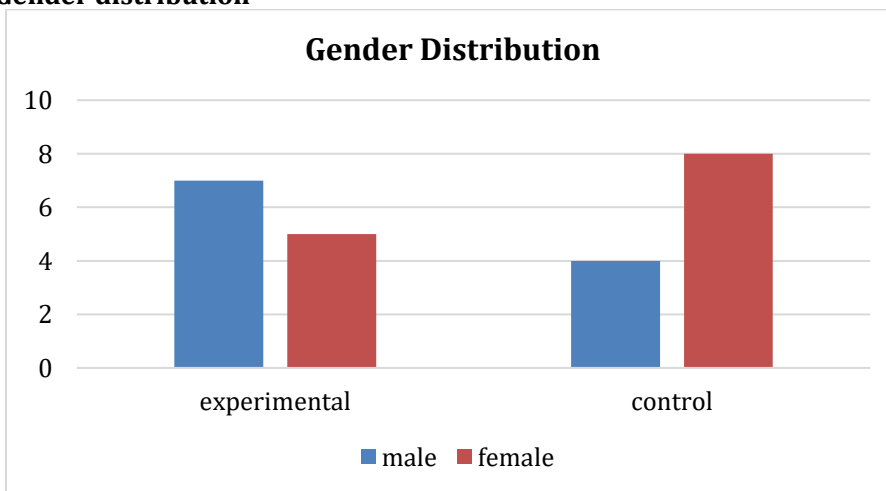
**Graph 1: age distribution**



**TABLE 1.2: GENDER DISTRIBUTION**

Group	No. of subjects	male	Female
experimental	12	7	5
control	12	4	8

**Graph 2: Gender distribution**



Groups	Mean	SD	t-value	p-value
PBS	6.25	2.70	8.016	0.001
CCS	0.41	0.52	2.80	0.01

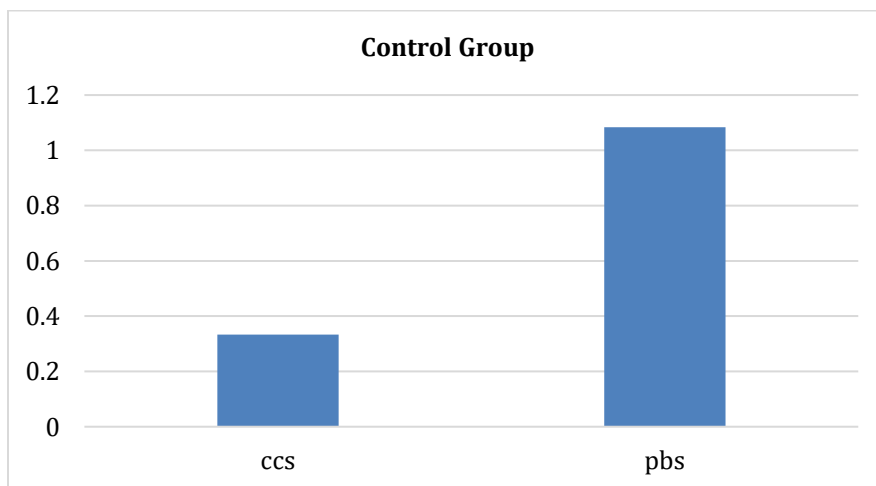
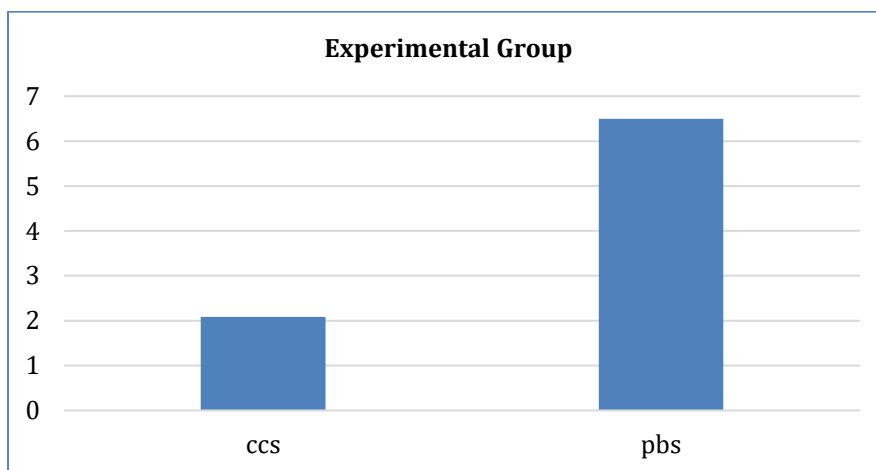
**TABLE 1.3: t-value and p-value within the experimental groups**

Groups	Mean	SD	t-value	p-value
PBS	1.083	0.90	4.16	0.002
CCS	0.583	0.66	3.02	0.01

**TABLE 1.4: t-value and p-value within the control groups**

	mean diff ± sd	t-value	p-value
PBS	1.08 ± 0.90	6.794	0.01
CCS	0.41 ± 0.51	2.803	0.00

**Table 1.5: unpaired t-test for both groups**



## **Discussion**

The purpose of this study was to determine the effect of Ball Throw and Catch Game on balance and co-ordination in children with Cerebral Palsy.

Before starting the study, co-ordination and balance were assessed by CCS and PBS respectively. The measurements were repeated after 10<sup>th</sup> session.

In the present study conducted, at the end of 10<sup>th</sup> session we found that the subjects in whom catching of the ball was improved showed associated improvement in CCS as well. The result showed that both ball throw and catch and conventional physiotherapy were effective in improving balance and co-ordination in children with cerebral palsy, but the ones who performed ball throw and catch with conventional therapy showed more improvement in balance and co-ordination among cerebral palsy children than conventional therapy group. This study shows significant improvement on balance and coordination in cerebral palsy children in experimental group.

This activity of ball catch and throw focused on motor relearning by enhancing skill in functional activity with adaptive neuroplastic changes in the cerebral cortex, brain stem, cerebellum and spinal cord. There is a growing interest in the phenomena of neural plasticity following CNS injury and its critical link to task-oriented activities such as this ball throw and catch game and other such activities.

This activity of ball throw and catch game focused mainly on improving motor performance, motor control strategies, sensory recovery, balance and activities daily living.

Raharjo et al in the year 2021 conducted a study and according to baseline condition treatment test poor eyes-hands movement coordination skill was observed. It was also observed that the selected sample were also not able to do catching correctly and concluded that throwing the ball was easier than catching the ball. After the evaluation treatment given was throwing and catching a ball game, by throwing the ball up and catching the ball using hands. The duration of the treatment was 10 days. The aim was to train sample's eyes and hands movement coordination skill that has issues in movement coordination skills. And in the ninth and tenth meetings, the child got better in movement coordination skills. Hence, the study conducted that throwing and catching the ball games can improve eyes and hand movement co-ordination skill to cerebral palsy dyskinesia type child.

Rintala et al in the year 2019 conducted a study to evaluate the influence of a 4-month physical activity program on selected physical fitness components, balance and ball skills, and the effect of specific treatments on physical fitness components, static and dynamic balance, ball catching and throwing accuracy of individuals with CP. Balance improved in a few cases but the changes observed were not consistent. Ball training didn't seem to have an effect on the skill of catching, but improvement in throwing accuracy was observed in all subjects.

Sutapa et al in the year 2021 conducted a study to evaluate the improvement of motor skills in early childhood through goal-oriented play activity. Goal-oriented play consisted of a series of activities comprised of walking on a balance beam, moving sticks, jumping goalposts, throwing balls, and arranging blocks. This study proved that goal-oriented play can improve motor skills in early childhood for children aged 4–6 years old. This was in accordance with research that showed that goal-oriented play can develop motor elements such as strength, durability, agility, speed, balance, and coordination. Goal-oriented play can develop multilateral skills, helping to build basic abilities. Basic movement, such as walking on the balance beam, moving sticks, jumping goalposts, throwing balls, and arranging blocks, is a part of children's educational and learning experiences that can be implemented easily in day care or preschool.

## **Conclusion**

This study suggests that playing throw and catch game can enhance balance and coordination in children with cerebral palsy. Long-term treatment could further improve these skills for more participants. This protocol of throwing and catching of ball should be used on daily basis for long-term improvement. This study has some limitations that the research is done across Ahmedabad city. Further study can be done in larger area can be taken with more number of subjects.

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