

## ASSESSMENT OF BILATERAL COORDINATION USING BRUININKS: OSERETSKY TEST OF MOTOR PROFICIENCY, 2<sup>ND</sup> EDITION (BOT-2), IN 5 TO 15 YEARS SCHOOL GOING CHILDREN

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### ABSTRACT

**Background:** Bilateral coordination refers to the ability to coordinate both sides of the body at the same time in a controlled and organized manner. The development of bilateral coordination begins early in the life and is the basis for further motor development. Inadequate bilateral coordination can adversely affect overall motor coordination as well as cognitive development, thus negatively affecting academic performance. Bruininks-Oseretsky Test of Motor Proficiency is a standardized assessment tool to assess children's motor proficiency, bilateral coordination being the 4<sup>th</sup> subtest.

**Materials and Methods:** The materials used were Bruininks-Oseretsky Test of Motor Proficiency, 2<sup>nd</sup> edition kit, table and a chair. The study was a cross sectional analytical study carried out in Pimpri Chinchwad Municipal Corporation schools. The subjects were selected by multistage sampling method and were asked to perform 7 tasks to assess bilateral coordination.

**Discussion:** The present study stated that, mean of bilateral coordination point score was more in males than females. The study also showed that, as a age increased, the mean of bilateral coordination point score increased both in male and female children.

**Conclusion:** Male children showed better performance than female and as the age increased, the performance got better.

**KEY WORDS:** Bilateral coordination, Bruininks-Oseretsky Test of Motor Proficiency, normal children.

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### INTRODUCTION

Bilateral coordination refers to the ability to coordinate both sides of the body at the same time in a controlled and organized manner, for example; stabilizing paper with one hand while writing/cutting with the other. It is the ability to use both sides of body in an integrated and skillful manner[1]. Neuromuscular development starts in embryonic stage and it continues after birth[2]. The development of bilateral coordination begins early in the life and is the basis for

further motor development. Good bilateral coordination/integration is an indicator that both sides of the brain are communicating effectively and sharing information[3].

Inadequate bilateral coordination can adversely affect overall motor coordination as well as cognitive development, thus negatively affecting academic performance. Bilateral coordination deficit is observed in children with Developmental Coordination Disorder(DCD), Learning Disability, Sensory Integrative Dysfunction and

other motor impairments[1]. Bilateral coordination forms part of the general evaluation of the motor skills. In clinical practice, bilateral integration deficits in children are identified by observations of poor coordination of two body sides, avoidance of crossing of midline, failure to develop a preferred hand and possibly right-left confusion. Some standardized tests such as Sensory Integration Praxis Test (Ayres, 1989), DeGangi Berk Test of Sensory Integration (1983), Bruininks-Oseretsky Test Of Motor Proficiency (Bruininks, 1978) and also its second edition[1].

The earlier version, the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP), is a widely used standardized assessment tool to assess children's motor proficiency with a long history of use in clinical practice and research. It is often used as the standard for criterion validation of other motor tests. It consists of 46 items grouped under 8 different subtests for children between 4.5 to 14.5 years of age [1]. The Bruininks-Oseretsky Test Of Motor Proficiency, Second Edition (BOT-2 preferred for this study as it is an individually-administered test that uses engaging, goal-directed activities) is to measure motor skills in individuals aged 4 through 21 (Bruininks and Bruininks, 2005). It assesses four motor-area composites; Fine Manual Control (FMC), Manual Coordination (MC), Body Coordination (BC) and Strength and Agility (SA). BOT-2 has 4 subtests with 53 items and each motor composite has 2 subtests [4]. As BOT-2 testing involves game-like motor tasks which capture the child's interest and are not verbally complex, it is suitable for children of non-English speaking background. Also the authors report that it can identify motor deficits in individuals with 'mild to moderate' motor impairment and is validated and reliable for assessing subjects with 'mild to moderate' mental retardation. Furthermore, the motor activities incorporated in BOT-2 include gross motor (GM) tasks that assess hopping, jumping, running, ball skills, balance, strength and coordination and fine motor (FM) tasks that assess precision, integration and manual dexterity through drawing, writing and functional tasks such as threading blocks [4].

BOT-2 has been empirically validated for high-functioning persons diagnosed with autism,

Asperger's, Developmental Coordination Disorder, and mild/moderate intellectual disabilities [5].

The Bilateral Coordination subtest of BOT-2 is the fourth subtest, Body Coordination (BC), under gross motor composite and contains eight test-items. First and fifth item assess coordination of upper limb alone and remaining six items assess sequential and simultaneous coordination of upper limbs with lower limbs. The number of performance trials for each item is specified. A raw score is recorded in the unit measured (e.g. number of jumps, pivots, etc.) and then converted to a numerical point score [1].

The Bilateral Coordination subtest measures the motor skills involved in playing sports and many recreational games. The tasks require body control, and sequential and simultaneous coordination of the upper and lower limbs. Sample's score is consistent with individuals who can perform coordinated arm/hand and leg/foot movements when the limbs on the same sides of the body are synchronized, but have difficulty with coordinated arm/hand and leg/foot movements when the limbs on the opposite sides of the body are synchronized [6].

A child who has attained all the normal developmental milestones at the correct age may also have certain motor deficits which may be asymptomatic at early stage of life due to which the child slowly start adapting to these deficits. This adaptive behavior may show neuromotor disturbances in later stages. Parents or teachers are unaware of these deficits and neglect it. Without intervention difficulties persist into adulthood and are frequently accompanied by other problems, both at home and at school, so assessment program should be done to evaluate children having coordination deficit and early intervention should be given to avoid the risk of any neuromotor disturbance later[7]. Thus, there is a need to assess bilateral coordination deficit in children to rule out the most common age group having this problem. At the same time, it is also important to see which gender is more prone to these deficit.

## MATERIALS AND METHODS

The study was to assess the bilateral coordina-

tion in 5-15 years school going children. The study was a cross-sectional analytical study which was conducted in schools from Pimpri-Chinchwad Municipal Corporation. 516 subjects of age group 5-15 years were selected in the study fulfilling the inclusion criteria. The subjects were divided into 5 age groups. Age group 1 comprised of children of age 5.0-7.11 years, age group 2 comprised of age 8.0-9.11 years, age group 3 comprised of age 10.0-11.11 years, age group 4 comprised of 12.0-13.11 years and age group 5 comprised of 14.0-15.11 years. The subjects included in the study were, healthy children both boys and girls of age 5 to 15 years. The exclusion criteria was children who had neurological trauma or spinal fracture 6 months back, any visual problem, any neurological deficit or diagnosed medical condition.

The objective of the study was, to find out bilateral coordination point score, to find out bilateral coordination descriptive category, to find out bilateral coordination point score and descriptive category among males and females and to find out bilateral coordination point score and descriptive category according to age groups using Bruininks-Oseretsky Test of Motor Proficiency, 2<sup>nd</sup> edition. The outcome measure used for conducting the study was, 'Bilateral Coordination Motor Point Score' and 'Descriptive Category of Bilateral Coordination'.

After explaining the purpose of the study to the subject/parent, they were informed about their right to opt out of the study any time during the course of the study without giving reason for doing so. The parents/teacher was assured that their child's participation and non-participation would not affect their child's education.

Subjects were selected on the basis of multi-stage sampling method. In the first stage, 3 English schools and 3 Marathi schools were selected randomly out of the total schools in Pimpri Chinchwad Municipal Corporation randomly. In the second stage, from each standard, 1 division was selected randomly. In third stage, from every division, equal number of boys and girls of same age were selected by stratified random sampling method. A written informed consent was obtained from the parents one day prior to the assessment. A pre assessment was taken to record their demo

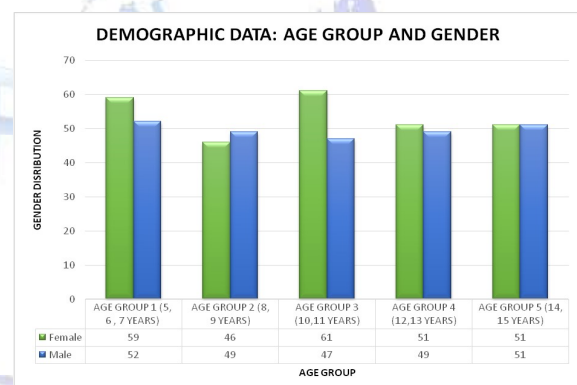
graphic details and other parameters.

Every child was asked to perform 7 tasks namely, touching nose with index fingers- eyes closed, jumping jacks, jumping in place- same side synchronized, jumping in place- opposite side synchronized, pivoting thumb and index finger, tapping feet and fingers- same side synchronized, tapping feet and fingers- opposite side synchronized.

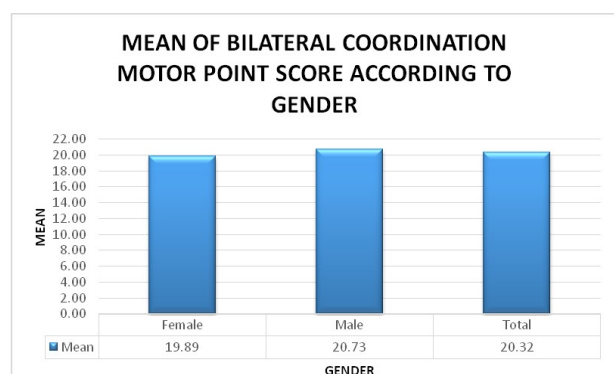
Subjects were assessed for these tasks and a raw score was recorded in the unit measured (e.g. number of jumps, pivots, etc.) and then converted to a numerical point score. Further analysis was done with the help of BOT-2 manual. The data collected was analyzed using suitable statistical tests.

## RESULTS

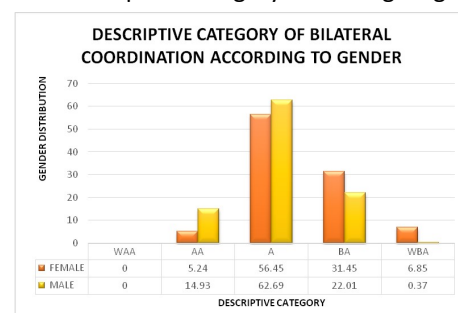
**Graph 1:** Demographic data: age group and gender.



**Graph 2:** Mean of bilateral coordination motor point score according to gender.

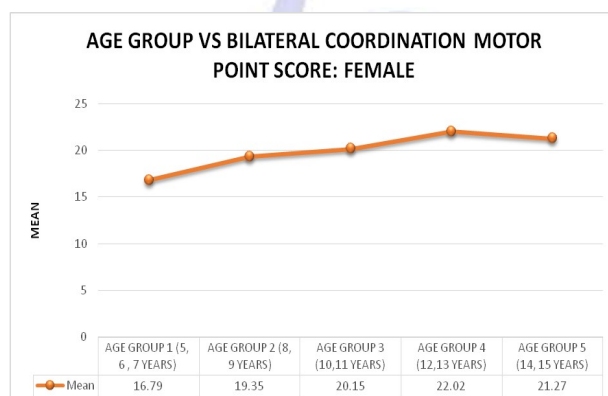
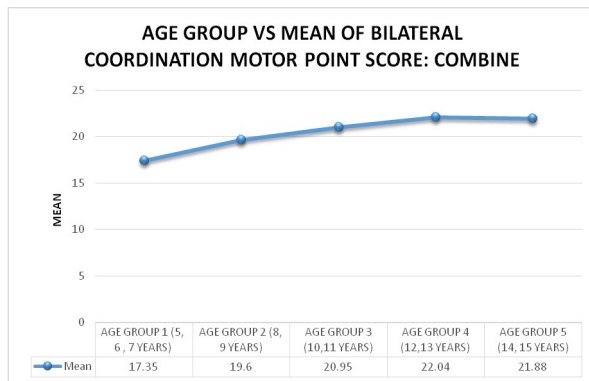


**Graph 3:** Descriptive category according to gender.

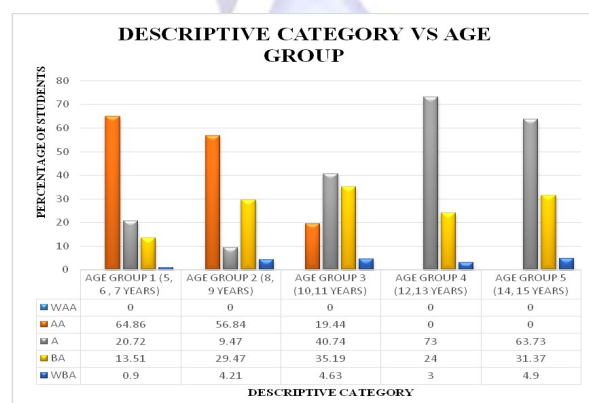




**Graph 4:** Mean and standard deviation of bilateral coordination motor point score according to age group.



**Graph 5:** Descriptive category of bilateral coordination according to age group.



The data analysis included mean and standard deviation of Bilateral Coordination Motor Point Score and age, gender and depicted categories according to BOT-2. The study showed the following result, Out of the total study population, 248 were male and 268 were female. The mean of bilateral coordination point score is more in male i.e. 20.72 than female i.e. 19.88. While considering the descriptive category, more males fall in average and above category than females and more females fall in below average and well below average category than males. None of the subject falls in well above average category. As the age group increases, the mean of bilateral coordination point score

increases both in males as well as females. While considering above average category, there are more subjects in age group 1 and none in age group 5. Whereas, while considering well below average category, there are more subjects in age group 5 and least in age group 1. None of the subjects fall in well above average category.

## DISCUSSION

The primary aim of the study was to assess bilateral coordination score using Bruininks-Oseretsky Test of Motor Proficiency, 2<sup>nd</sup> edition. It consisted of 7 items for assessing bilateral coordination.

The study was conducted among 516 subjects out of which 248 were male and 268 were female of age 5 years to 15 years 11 months, with mean age 10.67 years and standard deviation 3.03. The mean age and standard deviation for males was 10.66 and 3.02 respectively and that for females was 10.69 and 3.04 respectively.

In this study we found out that, as the age group increases the bilateral coordination score increases both in male and female. This is consistent with a study by T. Balakrishnan, where he said that the differences in the motor performances are not obvious before puberty in the boys and girls. The performance of both the gender improved with age [1].

The study also says that, mean of bilateral coordination point score was more in males i.e. 20.72 than females i.e. 19.88. According to the descriptive category, more males fall under above average and average category and more females fall in below average and well below average category. Thus, females are more affected than males as they fall more in below average and well below average category. Our result goes in accordance with the article where T. Balakrishnan et al in his study says that, bilateral coordination subtest primarily examines the coordination between nervous and muscular system in the arms and legs or on both sides of the body. Moreover, the motor performance is related to body stature, body weight, growth spurt, body composition, cardiovascular fitness and muscle strength. Physiologically males have more body weight and better body composition and cardiovascular fitness than females so their score is better [1]. Also Satabdi

Ghosh et al states that, nutritional status appear to be significant predictors for both fine and gross motor development. Nutritional status may alter the learning process by influencing brain development and physical growth and accordingly modify the movement proficiency of the children by adjusting the strength, power, coordination and perception [2]. Another study by Robert H. Bruininks says that bilateral coordination subtest measures motor skills involved in playing sports and many recreational games [7]. Males are involved more in such activities hence performed well than females

Further result shows the performance between different age groups. It says that by considering the norms given in the BOT-2 manual, more subjects from age group 1 i.e. 64.86% fall in above average category and the number deteriorates as age increases and none of them fall in above average category from age group 5. Likely, more subjects from age group 5 i.e. 4.9% fall in well below average category and the number decreases with age and least in age group 1. Thus, more children from age group 5 have motor impairment than other age groups. This result is in contrast with point score result as the descriptive categories are allotted according to the scale score. Brenda N. Wilson et al in their study said that, the use of subtest point score will result in a more precise measurement of function, because gains or deterioration will be related to specific areas of motor control. In addition, score that have undergone statistical transformations will be less exact in their ability to detect real changes that occurred. Because these standard scores are age adjusted, progress will not be reflected in the test scores unless the progress is faster than typical maturation. Therapists should consider using the subtest point scores as a more accurate measure of change [8].

Studies have shown that socioeconomic status alters the motor performance of child. Özgür Mülazımoğlu-Ballı in his study concluded that there were significant differences in the BOT-2 score and total score of different socioeconomic groups, in favour of high socioeconomic groups. Considering socioeconomic status is thus, important[9]. The study has outlined the limitation of not taking socioeconomic status and body mass index. We have also not considered the

medium of the school of the children.

## CONCLUSION

The study concludes that, male children showed better bilateral coordination score than female. Also, as the age group increases the bilateral coordination score increases.

## ABBREVIATIONS

**BOT-2 - BRUININKS – OSERETSKY TEST OF MOTOR PROFICIENCY, 2<sup>nd</sup> EDITION**

**Conflicts of interest: None**

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