# INFLUENCE OF SITTING ORIENTATION ON UPPER EXTREMITY FUNCTION IN NORMAL CHILDREN BETWEEN 5 TO 16 YEARS USING NINE HOLE PEG TEST

**Misal Amruta K[1], Kunde Chetana[2], Ganvir Suvarna S[3]**

*[1]UG student, [2]Assistant Professor, [3]Professor and Head, Department of Neurosciences, DVVPF's College of Physiotherapy, Ahmednagar, Maharashtra, India.*

## ABSTRACT

**Background:** This study was to measure the upper extremity performance time on Nine Hole Peg Test (NHPT) in two different sitting orientations relative to vertical plane. **Aim:** To find out the influence of sitting orientation on upper extremity motor function using NHPT. **Methods:** 100 children with the mean age 11year (53 male, 47 female) participated in the study. Children were selected according to inclusion and exclusion criteria. Age groups were re-established for data representation purposes as: 5-7, 8-10, 11-13, 14-16. Each one was briefly interviewed prior to the test, procedure explained and statistical analysis was done for the final results. **Results**: Gender wise relation revealed non-significant difference in performance time on NHPT in $90^0$ upright and $15^0$ anterior sitting orientation. Performance time on NHPT with dominant and non-dominant hand in $90^0$ upright & $15^0$ anterior sitting orientation shows significant difference. The mean performance time with dominant hand on NHPT was slightly lesser in $15^0$ anterior sitting orientation than $90^0$ upright orientations. According to age wise distribution the performance time on NHPT reveals that as the age increases the performance time decreases from 5-11 year. The performance time becomes constant from 11-16 years of age. **Conclusion:** Result of this study suggest that trunk orientation does not affect upper extremity performance on NHPT. As it implies that $15^0$anterior trunk orientation is equivalent to upright sitting orientation. Hence both the trunk orientation can be used to train patients for upper extremity hand function.

**Keywords:** Nine Hole Pig Test; Sitting orientation; Upper extremity function; Manual dexterity.

## INTRODUCTION

Postural control is the act of maintaining, achieving or restoring a state of balance during any posture or activity [1]. The body assumes various postures in preparation for engagement in various activities, sitting is the most common position assumed during daily motor activities, therefore, it appears to be important to evaluate seated stability and other components of sitting posture to assess accurately a person's ability to function. Trunk control and alignment affects functioning of the extremities as well as the performance of functional activities [2]. The influence of the postural control of the trunk and centre of the body on fine manual dexterity ability is a common assumption [1].

Manual dexterity is defined as the ability to integrate precision and speed with finely coordinated movements of the arm, hand and fingers [3]. Skilled movement requires complex patterns of muscular coordination based on motor patterns acquired during early life [4]. Nine Hole Peg Test is one of the commonly used tool for assessing dexterity. It was originally introduced in 1971 for assessing strength and dexterity [5].

All movements require constant change of posture and adjustment in the centre of gravity.4The reciprocal relations between posture and fine manual dexterity is evident in descriptions regarding the developmental sequence of acquiring movement control [6-8].

Previous study done by Glen Gillen, in 2007 states that upper extremity performance during daily activities improves in neutral trunk posture compare to forward flexed trunk.2Another study by Mijna Hadders-Algra, in 2013 confirms that forward tilting of seat surface improve postural control and quality of reaching [9]. It is assumed that there is a strong relationship between postural control and fine motor abilities. Hence the purpose of this study was to measure the upper extremity performance time on Nine Hole Peg Test in two different sitting orientations relative to vertical plane.

## MATERIALS AND METHODS

**Ethics approval:** Ethics committee of our institute approved the study protocol. After it was determined the parents had read and agreed with the approved consent.

**Study location:** DVVPF's College of Physiotherapy

**Study period:** One year

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**Correspondence:** Amruta K. Misal, DVVPF's College of Physiotherapy, Ahmednagar, Maharashtra.
E-mail: amrumisal@gmail.com

**Samples size**: 100 children with the mean age 11year (53 male, 47 female) participated in the study. Participants were recruited from a school.

**Inclusion criteria:** Normal school going children, Male and Female, age group 5 to 16yrs cognitively stable were included in the present study.

**Exclusion criteria:** 1) if no parental consent 2) Hand deformity and Spinal deformity.

**Procedure:** Age groups were re-established for data representation purposes as: 5-7, 8-10, 11-13, 14-16. Form, each one was briefly interviewed prior to the test and the following information obtained: age, gender, and hand dominance. Selection was done by lottery method with different age group wise distribution.The subjects was then explained about the procedure of the test, the subjects was asked to perform the test. The test was conducted in isolated environment under the supervision of class in-charge, child was made to sit on wooden stool with appropriate 900 flexed position of elbow with the desktop in front. Children was explained about procedure. One trial session will be given to the children before application of test. Subject was performed test on cue. Children has to pick peg from container and put it in peg board and once all pegs are placed then again remove pegs one by one and store it in container. The test is timed with a stop watch from the moment the participant touch the first peg until the moment the last peg hit the dish. And this is done thrice and their mean is recorded for two different orientation of trunk [10].

**Statistics:** Statistical analyses were performed using Instat 3 application for the evaluation of the gender wise difference in performance time, age wise variance as well as to find out performance time of upper extremity motor function in dominant and non-dominant hand using Nine Hole Peg Test, we mainly used the nonparametric test

## RESULTS

**Table 1. Gender wise relation revealed non-significant difference in performance time on nine hole peg test in 900 upright and 150 anterior sitting orientation**.

| Sitting orientation | Mean ± SD | | P Value |
|---|---|---|---|
| | Male | Female | |
| $90^0$ Upright | 20.18 ± 5.05 | 21±5.61 | 0.3301 |
| $15^0$ anterior | 19.81 ± 5.09 | 19.95±5.50 | 0.8819 |

**Table 2. Performance time on nine hole peg test with dominant and non-dominant hand in 900 upright & 150 anterior sitting orientation**

| Orientations | Mean ± SD | | P Value |
|---|---|---|---|
| | Dominant hand | Non-Dominant hand | |
| $90^0$ Upright | 20.570 ± 5.31 | 22.997±5.65 | *<0.0001* |
| $15^0$ Anterior | 19.785 ± 5.20 | 22.653 ±5.30 | |

Performance time on nine hole peg test with dominant and non-dominant hand in 900 upright & 150 anterior sitting orientation shows significant difference (<0.0001).

**Table 3. The mean performance time with dominant hand on nine hole peg test**

| | Mean ± SD | | P Value |
|---|---|---|---|
| Dominant hand | $90^0$ Upright | $15^0$ Anterior | 0.1498 |
| | 20.48± 5.21 | 19.78 ± 5.20 | |

Statistical analysis reveals non-significant (0.1498) in performance time with the dominant hand in both the posture orientation.

**Table 4. According to age wise distribution the performance time on Nine Hole Peg Test**

| Age group | Mean ±SD |
|---|---|
| 5-7 | 28.016 ±5.24 |
| 8-10 | 20.469 ± 3.16 |
| 11-13 | 17.645 ± 2.20 |
| 14-16 | 17.159 ± 1.71 |

Nine Hole Peg Test reveals that as the age increases the performance time decreases from 5-11 year. The performance time becomes constant from 11 to 16 years of age.

## DISCUSSION

Result of this study indicates trunk orientation does not affect performance of upper extremity hand function in normal children. As the performance time was comparative lesser in anterior orientation but statistically it shows non-significant different, as the anterior trunk orientation induces a more straight sitting position,9 which is equivalent to upright sitting which might led to no difference in upper extremity performance time on nine hole peg test. Although this finding is contradictory to the result of Glen Gillen who suggests neutral trunk alignment improves upper extremity performance in healthy adult. Even study done by Olunwa

Nafiana Nwaobi reports performance time improves in upright trunk orientation in cerebral palsy children [10]

Various studies have documented the effect of trunk orientation on upper extremity performance time using various manual performance parameters [2,10,11] this is the first study to report upper extremity performance using dexterity measure using nine hole peg test in children. Therefore our study has compare hand dexterity in dominant and non–dominant hand in 900 upright and 150 anterior orientation of trunk. Our data from dexterity testing with NHPT showed that the dominant hand completed test faster compared to non - dominant hand in both the trunk orientation. The superior performance of dominant hand over non-dominant hand has been attributed to hemispheric lateralization12 contradictory finding of Hage JJ reported that there was no difference between dominant and non-dominant hands [13]. Result of this study was favoured by the finding of Armstrong and Oldham observed small but significant differences between the dominant and non-dominant hands [14].

There were total 55 male and 45 female children, in gender wise analysis suggest no difference in upper performance time with the different trunk orientation the reason may be due to skill activities are not diverted at this age and all the children perform same activity as per school curriculum till 16 years. It was also observed in the study that as the age increases performance time decreases till 11 years of age. After 11 years performance time becomes constant, this reflects that manual dexterity becomes mature by this age.

## CONCLUSION

Result of this study suggest that trunk orientation does not affect upper extremity performance on nine hole peg test. As it implies that 150 anterior trunk orientation is equivalent to upright sitting orientation. Hence both the trunk orientation can be used to train patients for upper extremity hand function.

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