NORMATIVE DATA OF MOTORFREE VISUAL PERCEPTION TEST-4 (MVPT-4) AMONG CHENNAI CHILDREN

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Abstract

The purpose of this study was to establish normative data of the Motor Free Visual Perception Test-4 (MVPT-4) among Chennai population aged 6-10 years. The study also intended to (a) To identify the influence of gender on performance in MVPT-4. (b) To compare the performance of Chennai children and US children on MVPT-4.A quantitative Research – Cross-section study. A total of 1000 participants aged 6 to 10 years were engaged in the study from community setting located in Chennai using a convenience sampling method. The study participants were Screened with visual foundation skills such as visual tracking, saccadic eye movements, convergence, and divergence. Children with good visual foundation skills were administered with MVPT- 4. The study found a statistically significant difference in the performance of MVPT-4 between each age group ($F = 64.698$; $p = 0.000$). The finding revealed that there was no influence of gender on performance in MVPT-4. The study also found that the performance of Chennai children on MVPT-4 is substantially better than the performance of United States children.The established normative data can be used in the screening of visual perceptual deficits and to plan the intervention and to identify effectiveness of the therapy.

Keywords: Visual perception, Normative data, Visual-Motor Integration, Motor-free visual perception.

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Introduction

Visual acuity refers to the sharpness of vision in the fovea – the portion of the retina where the individual fixes their gaze on the target and is measured commonly using the Snellen chart[1]. Visual field refers to the extent of the area visible to an eye in a given position, its extent is approximately 65° upwards, 75° downward, 60° nasally, and 95° temporally respectively.

The capacity of the eye to vary its dioptric power or focusing power to keep a clear picture on a target while its distance changes are known as accommodation[2].

The ability to combine pictures from both eyes into a single perception is known as binocular fusion. Binocular fusion requires two requirements – Motor fusion (both eyes coordinate to focus on the object of attention) and Sensory fusion (the consistency of the image size and Clarity on both eyes).Stereopsis is the monocular or binocular depth perception or three-dimensional vision[3].

The capacity of an eye to turn nasally and temporally as the object of interest travels towards or away from the observer is known as convergence and divergence[4].Visual Perception (VP) is the ability to "receive (sensory function) and organize visual information from the environment, as well to interpret the received visual information with the cognitive function". It entails recognizing forms, colours, and the orientation of things or shapes in space, as well as the relationships between objects or shapes and the environment[5].

Visual Processing information plays a critical role in school functioning activities like reading, handwriting, and mathematical calculation and it impacts overall academic achievement[6]. In 1982, Kavale conducted a meta-analysis of 161 important researches involving VP and reading skills and his findings revealed that VP is a key predictor of reading proficiency in school. Age, Visual sequential memory, and Visual-motor integration were recognized as three major

predictors of legibility and handwriting speed by Tseng and Chow[7].A school-going child has to spend most of his time in reading, writing, and other academic-related tasks that rely on visual perceptual skills[8].

Studies confirm that Children with VP difficulties have been linked to several academic-related problems such as reading, writing ,mathematicsand it impacts overall academic achievement. Therefore, School going Children with VP difficulties may struggle with academic tasks such as legibility and speed of handwriting , reading without error, identification of mathematical symbols, and numerical[9].

Poor Visual Perception skills may also affect performance skills like Motor skills and social skills like Facial expression and as a result, children have difficulties in various Occupations (ADL, IADL, Education, Play, Social participation) across different settings[10].VMI is recognized as the "best predictor of legible Handwriting". Handwriting problems with a low score on the VMI test may be due to the underlying cause like Visual-cognitive impairments (visual discrimination, visual attention, visual memory), and poor motor coordination. This suggests an extensive evaluation to identify the underlying issue[11].

Many children are referred to occupational therapy services presenting with VP dysfunction with the diagnosis of developmental delay, learning problems, neurological disabilities[12].Therefore, VP abilities are becoming more often tested as part of psycho-educational evaluations to assess foundation skills needed for academic learning. There arevarious norm-referenced tools available to evaluate visual perception skills like,

    1) Developmental Test of Visual-Motor Integration (Berry,1997),

    2) Developmental Test of Visual Perception (DTVP) (Frostig, 1966)

3) Test of Visual Perceptual Skills (TVPS) (Gardner, 1982),

4) Motor Free Visual Perception Test (MVPT) (Colaursso & Hammill, 1972)

5) Sensory Integration and Praxis Test (SIPT) (Ayres, 1989)

Occupational therapists have become frequently using Motor Free Visual Perception Test to identify children with Academic difficulties and to screen VP problems. But, norms of MVPT-4 were established with the western population[13]. There is much evidence that there is a difference in visual perceptual skills between Hong Kong children and western children[14]. Therefore, due to cultural influence on Visual perceptual skills development, norms have been established globally for various visual perception assessments[15].Since there is no normative data for MVPT-4 in the Indian context, the current study was established Normative values for MVPT– 4 of age 6-10 years among Chennai Children.

METHODOLOGY

This study obtained approval from the institutional Ethical committee of SRM Medical College and Research Centre. Ethical Clearance No: 2087/IEC/2020. The research design adapted in the research is Quantitative Research – Cross-section study.A convenience sampling of 1000 children from the age group of 6-10 years from different parts of Chennai to avoid geographical variation. based on the inclusion criteria and any child with poor Visual foundation skills and Intellectual disabilities were excluded from the study

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Children were recruited to be recruited from school. The purpose of the study was explained to parents to include their ward in the study. The study participants were Screened with visual foundation skills such as visual tracking, saccadic eye movements, convergence, and divergence. Children with good visual foundation skills were administrated with MVPT- 4th edition in a disturbance-free environment with good lighting. Almost 20-25 minutes was taken to administer the MVPT- 4th edition for each child. The instruction and scoring procedures were carried out as per the guidelines given in the MVPT- 4th edition manual.

Data collection

The collected data were computed using the software IBM SPSS 23.0 version. The descriptive statistical analyses were performed to obtain the mean scores and SD scores of performance of different age group children in MVPT-4th edition. The inferential statistical method was performed to find the gender difference, age difference, and difference between the US population and the Chennai population.

Figure.1: Administration of MVPT-4.

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Table No. 1:The performance of Chennai children on MVPT-4

S. No.	Age group	N	Mean	SD	F value	'p' Level of significance
1	6.0 - 6.11	200	25.43	3.256		
2	7.0 - 7.11	200	29.13	2.515		
3	8.0 - 8.11	200	31.70	2.152	64.698	0.000**
4	9.0 - 9.11	200	34.37	2.356		
5	10.0 - 10.11	200	33.17	1.511		

$p \leq 0.05$

One-way ANOVA was used to identify Chennai children's performance on MVPT-4.The result depicts that there was a statistically significant difference (F = 64.698; p = 0.000) between age groups among Chennai children

Table No.2: Comparison of performance of Chennai children and United States children on MVPT-4

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Age interval	Chennai children		U.S children		t value	p-value
	Mean	SD	Mean	SD		
6.0 - 6.11	25.43	3.256	23.30	5.290	2.084	0.039*
7.0 - 7.11	29.13	2.515	25.24	6.200	3.355	0.001**
8.0 - 8.11	31.70	2.152	27.17	5.250	4.601	0.000**
9.0 - 9.11	34.37	2.356	28.98	5.260	5.441	0.000**
10.0 - 10.11	33.17	1.511	29.59	5.280	3.669	0.000**

$p \leq 0.05$

Independent 't' test was used to compare the performance of Chennai and United States children on MVPT-4. The result that there was a statistically significant difference between Chennai and United States children on MVPT-4 in the age groups of 6.0 – 10.11 years (t = 2.084, p = 0.039; t = 3.355, p = 0.001; t = 4.601, p = 0.000; t = 5.441, p = 0.000; t = 3.669, p = 0.000 respectively).

DISCUSSION

Table No. 1 revealed that there was a statistically significant difference between age groups among Chennai children, which means there was an age-related developmental progression between age groups of children. The MVPT is related to the chronological age that means the performance of Visual perception increases as the chronological age increases. The age-related progression in Visual perception is due to the neural maturation resulting from environmental exploration and experimentation that occurs through environmental affordance.

In this study, the mean score of 10.0 – 10.11 years is lower than the mean score of 9.0 - 9.11 years which might be due to the influence of data resulting from lack of equal distribution of socioeconomic status. In the 10.0 – 10.11 age group the distribution of low socioeconomic status

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was in greater percentage which might have resulted in a lower mean score than the 9.0 – 9.11 years age group. This result is similar to the findings of Garzia, R. (2014). They found that children in high socioeconomic status performed well in MVPT-3 than children in low socioeconomic status[15]. Further, they concluded that the reason for the link between visual perceptual skills and socioeconomic status is complex and multifactorial. However, they reasoned out that, children with low socioeconomic status have fewer opportunities to access materials and activities (environmental affordance) that improve visual perceptual skills compared to children with high socioeconomic status and the result is consistent with the previous findings[16].

Table No. 2 compare the performance of Chennai children and United States children on MVPT-4. The results showed that there was a statistically significant difference among Chennai & the United States population on MVPT-4 in the age groups of 6.0 – 10.11 years. Hence, the performance of Chennai children on MVPT-4 is substantially better than the performance of United States children.The result is consistent with the previous findings of Ho et al., 2015 in their normative study of TVPS among Hong Kong Children, in this study they concluded that Hong Kong children performed well in TVPS than the United States children.

The cultural difference in the development of VP between Chennai and United states children may be due to the early involvement of Chennai children in academic activities such as reading and writing the complex geometric forms of Tamil letters may enhance the Visual perceptual skills of Chennai children

Conclusion

This study established the normative score of Motor Free Visual Perception Test – 4 among the Chennai population aged 6 - 10 years. Using the convenience sampling method a total of 1000 children were recruited from different parts of Chennai in a school. The study participants were screened with Visual foundation skills and administrated with MVPT-4. The result of the study revealed that there was a statistically significant difference between the age groups among Chennai children. The study also found the absence of a statistically significant difference between genders in MVPT-4 among Chennai children. This study also indicates that the performance of Chennai children on MVPT-4 is substantially better than the performance of United States children. The established norms can be used in the Chennai population for screening and treatment planning.

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