

Test-Retest Reliability for Test of Visual Perceptual Skills (Non-motor)-Revised in Normal Children (Age 4-12 Years)

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Abstract

Objective: To assess test- retest reliability for Test of Visual- Perceptual Skills (non-motor) - Revised (TVPS-R) in normal children (Age 4 to 12 years).

Study Design

Cross sectional

Methodology

240 children between age groups 4 to 12 years attending normal school were recruited for the study. TVPS-R was administered twice with a gap of one week duration to find test retest reliability

Results

The intraclass coefficient correlation for the total test ranged from 0.83 to 0.97 indicating good test retest reliability. The intraclass coefficient correlation for each subtest ranged from 0.21 to 0.97 indicating very poor to good test retest reliability. In the results of individual subtests, variations were found most commonly in the subtests of visual memory and visual sequential memory. In visual memory, 5 age groups (5-6, 7-8, 9-10, 10-11, and 11-12) and visual sequential memory, 5 age groups (4-5, 7-8, 9-10, 10-11, and 11-12) showed poor to moderate intraclass coefficient correlation ranged from 0.21 to 0.65.

Conclusions

Total test scores of TVPS-R shows good test-

retest reliability. Test-retest reliability of individual subtests shows variations. Thus in clinical decision making or treatment planning, TVPS-R total test scores should be considered, rather than the individual subtest scores.

Key Words

visual perception, motor problems, reliability

Introduction

Perception refers to integration of sensory impression into psychologically meaningful information.¹ The development of visual perception begins at birth with the reception of visual stimuli, followed by orientation of the head and eyes and the identification and integration of dominant visual cues.²

The child's first perceptions of his world develop primarily from tactile, kinesthetic, and vestibular input. Vision and auditory input is later matched against the other senses and integrated in to the child's perception of his world. Because visual perception is believed to be the end product of normal sensory integration, many motor control issues with a visual motor and visual-perceptual basis are considered as dysfunctions with in the realm of sensory integration. Visual perception has a direct impact on eye hand coordination, eye-hand and eye foot dissociation.³

In the developing child, there is a systematic increase in the ability to perceptually analyze and discriminate objects. Visual perception contributes to the performance of school related tasks such as copying, reading, spelling, and art skill. Visual perception is used to validate other sensory and motor information coming into the system and sub serves motor coordination and performance. A child who has sensory processing problems will have problems in visual perception and will appear disorganized and

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scattered in his motor function.³ For a visual perception deficit to be identified the primary senses such as visual acuity must be intact.¹

Children with motor problems have frequently been identified as a group with visual perceptual problems. Visuospatial and perceptual deficits may impair gross motor performance and functional independence in a child. A figure ground deficit or the inability to distinguish a given form from the background may make a change in terrain depth during gait training.⁴

It has long been recognized that severe disturbances in visual perception can interfere with activities of daily living.⁵ It is important to consider assessment of visual perception in the children with motor problems. Visual stimulation is one of the therapeutic measures given to these children. To find the effectiveness of any therapy, outcome measures are important. Test of visual perceptual skills (Non-motor) Revised (TVPS-R) is one of the outcome measures to assess the visual perception.

Gardiner⁶ designed the motor free test of visual perceptual skills (Non-motor) Revised (TVPS-R) to assess the visual perception in 4 to 12 years old children. The TVPS-R involves the use of predawn configurations and design there by excluding any motor component in the administration. The TVPS-R assesses visual

perceptual strengths and weakness in children 4 to 12 years. The test consists of 112 items grouped in 7 subtests (i.e. visual discrimination, visual memory, visual spatial relationships, visual form constancy, visual sequential memory, visual figure ground, visual closure).

When selecting a test for use with children in clinical practice or in research, professionals need to consider the reliability and validity of the test.^{7,8} One essential type of reliability is test retest reliability. It is an index of score stability overtime that allows therapist to be confident that score changes reflect change in the subject performance rather than random error. Test retest reliability of TVPS-R was not reported in the manual, Chan et al⁹ studied Test retest reliability of TVPS-R for 4-5 years of age, but it is used for 4-12 years of age, so there was a need for Test retest reliability of TVPS-R for 4-12 years of age.

Methodology

Subjects

Children between age groups 4 to 12 years attending normal school were recruited into the study. 30 children from each age group, aged between 4-12 years and a total of 240 children were assessed. The demographic data of the children is given in Table 1.

Table-1: Demographic Data

AGE	N	BOYS	GIRLS	MEAN AGE(MONTHS)	S.D OF AGE
4-5 YEARS	30	14	16	54.33	2.45
5-6	30	18	12	66.60	2.56
6-7	30	14	16	77.66	3.41
7-8	30	15	15	85.93	2.44
8-9	30	15	15	101.00	2.61
9-10	30	15	15	113.43	2.34
10-11	30	15	15	126.80	2.46
11-12	30	15	15	138.26	2.59
TOTAL	240	121	119	54.33	2.45

Inclusion Criteria

Children attending to normal school (Age 4 to 12 years)

Exclusion Criteria

1. Children diagnosed with physical, intellectual or sensory impairments.
2. Children with special educational needs.
3. Uncooperative children

Instruments

- Test of Visual Perceptual Skills Manual, testing plates, and record forms.
- Two chairs
- Table
- Stop watch
- Isolated room

Procedure

The study was conducted during the period of April 2006 and January 2008. Approval was taken from scientific committee and Institutional Ethical Committee. The list of schools in Mangalore and consent for carrying

out the study was obtained from Block Education Officer, Mangalore. From a list of 119 schools, 3 schools were selected randomly by lottery method for conducting the study. Out of the 3 schools, one school refused to give consent for the study, subsequently, one more school was selected from the remaining schools by lottery method.

Based on sample size calculation, a sample size of 240 was obtained. In the present study, the children were divided into 8 subgroups (4-5 years, 5-6 years, 6-7 years, 7-8 years, 8-9 years, 9-10 years, 10-11 years, and 11-12 years). Under each subgroup there were 30 children. Therefore 10 children were selected in each age group from each of the 3 schools. Informed consent was taken from the Principal and concerned class teacher of each school. Each child was taken to a calm, distraction free room. The test procedure was explained and test was administered individually for each child according to the instructions given in the manual. Figure 1 shows tests plates and Figure 2 shows the test being performed on a child. Each subtest consists of simple

Figure 1: TVPS-R test plates

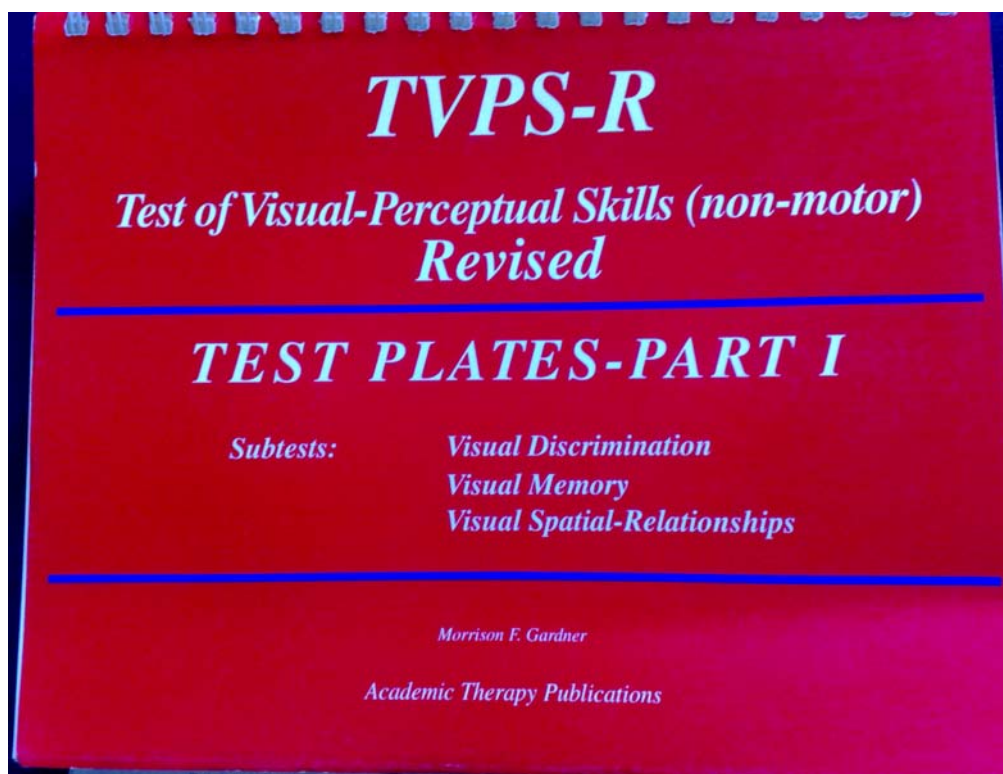


Figure 2: Testing of Visual perception on an 8 year old girl using TVPS-R



Verbal instructions of either one or two sentences e.g. - look at this form and remember it so that you find it on another page. Find it among these forms. In all the subtests children were required to indicate the correct answer out of either 5 choices by any means (e.g. by pointing or verbal indication). Each subtest ends when the child makes 3 errors on 4 consecutive items on a subtest with 4 choices or 4 failures on 5 consecutive items on a subtest with 5 choices.

The test was stopped when the child attained ceiling and preceded with the next subtests. The same procedure was repeated after one week in the same environment. All the children were made to undergo the test procedure in the same way.

Data Analysis

The statistical analysis was done using the SPSS 11.0 software package. The test and retest

total scores and subtest scores of TVPS-R was estimated by intraclass coefficient correlation (ICC) by using Pearson product moment correlation formula.

Results

A total of 240 children participated in the study. The ICC of the test- retest reliability for the total test ranged from 0.83 to 0.97 indicating good test retest reliability (Table 2). The ICC for each subtest ranged from 0.21 to 0.97 (Table 2) indicating very poor to good test retest reliability.

In the results of individual subtests, variations were found most commonly in the subtest of visual memory and visual sequential memory. In visual memory, 5 age groups (5-6,7-8,9-10,10-11, and 11-12) showed poor to moderate ICC. (Table 2). In visual sequential memory, 5 age groups (4-5, 7-8, 9-10, 10-11, and 11-12) showed poor to moderate ICC. (Table 2)

Table - 2: ICC values of TVPS-R (4 – 12 years)

Age (years)		4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12
D	r - value	0.873	0.649	0.521	0.33	0.466	0.786	0.802	0.682
	ICC	0.932194	0.787144	0.685076	0.496241	0.635744	0.880179	0.890122	0.810939
M	r - value	0.945	0.359	0.565	0.492	0.636	0.297	0.391	0.301
	ICC	0.971722	0.52833	0.722045	0.659517	0.777506	0.45798	0.562185	0.462721
SR	r - value	0.488	0.727	0.742	0.728	0.888	0.468	0.621	0.422
	ICC	0.655914	0.841922	0.851894	0.842593	0.940678	0.637602	0.766194	0.59353
FC	r - value	0.848	0.398	0.304	0.76	0.692	0.398	0.542	0.717
	ICC	0.917749	0.569385	0.466258	0.863636	0.817967	0.569385	0.702983	0.835178
SM	r - value	0.376	0.833	0.761	0.162	0.587	0.119	0.227	0.469
	ICC	0.546512	0.908893	0.864282	0.27883	0.739761	0.21269	0.370008	0.63853
FG	r - value	0.872	0.735	0.605	0.599	0.344	0.526	0.517	0.372
	ICC	0.931624	0.847262	0.753894	0.749218	0.511905	0.689384	0.681608	0.542274
VC	r - value	0.714	0.666	0.551	0.65	0.826	0.695	0.727	0.263
	ICC	0.833139	0.79952	0.710509	0.787879	0.90471	0.820059	0.841922	0.416469
total	r - value	0.948	0.886	0.821	0.885	0.84	0.712	0.81	0.878
	ICC	0.973306	0.939555	0.901702	0.938992	0.913043	0.831776	0.895028	0.935037

VD -Visual discrimination

VSR -Visual spatial relationships

VSM-Visual sequential memory

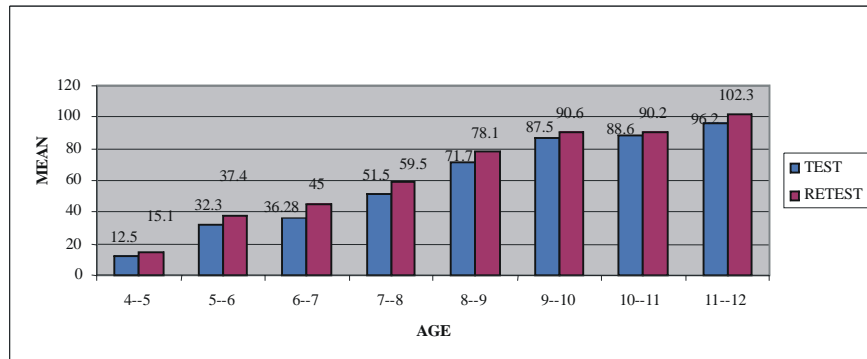
VC -Visual closure

VM -Visual memory

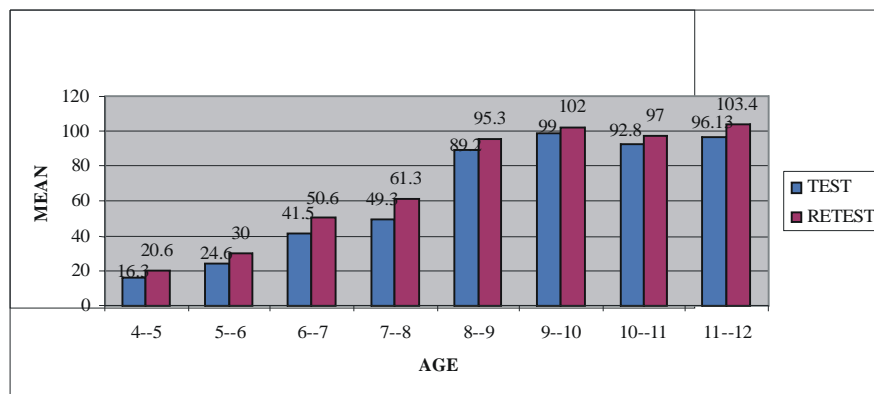
VFC -Visual Form Constancy

VFG -Visual figure ground

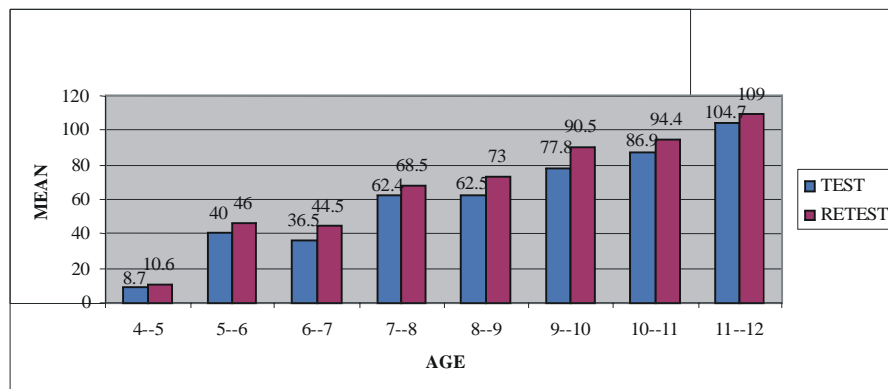
Graph - 1; TVPS-R total mean scores of test and re-test for children 4-12 years



Graph - 2; TVPS-R total mean scores for Boys (4-12 years)



Graph - 3; TVPS-R total mean scores for Girls (4-12 years)



It can be observed in graphs that the re-test scores were high irrespective of age group, but this increase in mean values have not shown any significant statistical difference, thus indicating a good test-re test reliability. It also shows that as age increases the total mean scores also increases (graph 1, 2 and 3).

Discussion

In the present study total test scores showed good test-retest reliability for 4-12 years of age,

ICC ranging from 0.83 to 0.97, similar to the findings reported by McFall et al¹⁰ and Chan et al.⁹ But the individual subtest scores showed poor to good reliability, ICC ranging from 0.21 to 0.97.

Our results also showed that there was a slight improvement shown in retest values in all the age groups, the reason may be due to the fact that children became familiar with the test plates, environment and the tester. We also

observed that during retest, the speed of performance improved.

Out of 7 subtests only visual memory and visual sequential memory showed poor to moderate reliability in 5 age groups, whereas the other 5 subtests showed good to moderate reliability in more than 7 age groups. The reasons could be that the children needed to match one form from a set of given forms on the same test plate, thus giving the child an opportunity to constantly compare the form to be matched or discriminated from other forms on the same test plate.

In our study visual memory and visual sequential memory showed poor to moderate reliability. These subtests involved the child to memorize one form and also the child has to recall the same form in the subsequent test plate, unlike the other subtests where there was no need of recalling the test forms. As the test plates progressed, difficulty in the test plates increased resulting in greater difference in the test and retest values for these subtests. Memory recall and motivation could be one of the factors which led the child to perform better in the retest or to reach the ceiling effect much earlier in the retest.

Our results also showed that TVPS-R is free from gender bias and supports the use of this test for children of both genders without the need for separate items or norms, for different genders similar to results reported by Chan et al.⁸

It was also observed that children of 4-6 years of age reached ceiling effect faster. Probably it was due to less ability to concentrate on one activity. As the age increased they were able to concentrate and perform the tests for longer period of time.

In our study it was observed that, as the age increases from 4 to 12 years, there is a gradual increase in total scores of TVPS-R, indicating that visual perception improves with age. From 8 years onwards there is a steep increase in total scores of TVPS-R as shown in Graph 1. The above results shows that when TVPS-R is used for decision making or treatment planning, the total test scores should be considered and not the subtest scores.

Future Suggestions

- The test-retest reliability of TVPS-R can be done on children with various motor disabilities.
- TVPS-R can be used as one of the outcome measures to evaluate intervention programs for visual-perceptual problems.

Conclusion

- Total test scores of TVPS-R shows good test-retest reliability
- Test-retest reliability of individual subtests shows variations. Thus in clinical decision making or treatment planning, TVPS-R total test scores should be considered, rather than the individual subtest scores.
- Therapists can have a good confidence in data collection and they can draw rationale conclusions from the total test scores of TVPS-R

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