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A Comparison of Two Procedures to Assess Visual Perceptual Skills of Children With Cerebral Palsy

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국문요약

뇌성마비의 시 지각 검사를 위한 평가도구의 비교

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이 연구의 목적은 Motor-Free Visual Perception Test (MVPT)와 Mariannene Frostig Developmental Test of Visual Perception (DTVP)을 사용하여 뇌성마비 아동과 정상아동의 시 지각 능력의 차이를 알아보고, 뇌성마비의 사지마비군과 양하지마비군, 그리고 정상아동군에서 두 평가도구의 결과에서 제시한 시 지각능력의 차이를 비교하기 위한 것이다. 뇌성마비 아동 21명(사지마비 11명, 양하지마비 10명)과 정상아동 8명을 대상으로 하였다. 대상의 연령범위는 4세에서 8.5세이었다. 시 지각 능력을 평가하기 위하여 운동기능을 포함하지 않은 MVPT와 운동기능을 포함한 DTVT를 사용하였다. 평가과정과 방법은 표준화된 지침서에 따라 수행하였다. 자료분석은 SPSS를 사용하여 Wilcoxon signed rank test와 Mann-Whitney, Kruskal-Wallis를 하였다. MVPT와 DTVP의 지각지수를 뇌성마비 아동과 정상아동을 비교한 결과 뇌성마비 아동의 지각지수가 정상 아동보다 유의하게 낮았다. 아동의 교정연령과 MVPT와 DTVP의 지각연령의 차(CA-PA)를 사지마비군, 양하지마비군, 그리고 정상군과 비교한 결과 정상군에서는 두 평가도구 간의 차이가 없었으나, 사지마비군에서는 두 평가도구 사이에 유의한 차이가 있었다. 이 연구의 결과는 뇌성마비 아동의 시 지각능력을 평가하기 위한 도구로 MVPT의 사용을 제시하였다.

핵심단어: 뇌성마비; 시 지각; 시 지각 평가도구.

Introduction

Children with cerebral palsy (CP) often have problems of visual perception along with motor disability. Two arguments supporting this result are first: that cerebral

palsy is often the suspected cause of both motor impairment and visual misperception. Second: the likelihood of a visual perceptual deficit is increased in any sample of children with quadriplegic type motor disability. Many theorists postulate a direct relationship between the severity of motor development defects and visual perceptual deficits. Significant deficits in one skill usually produce some impairment of function in the other (Friedrich and Fuller, 1974; Newcomer and Hamil, 1973).

It is equally possible, however, that the observed high incidence of perceptual disorders in quadriplegic type CP may be a function of the visual perception itself, test itself. Colarusso's (1972) review of many standard visual perceptual tests suggests that they require not only perception, but also the ability to reproduce the percept through some motor process, usually drawing. Commonly used visual perception tests include the Bender Visual-Motor Gestalt Test (Bender, 1938), the Memory-For-Designs Test (Grahan and Kendall, 1960), the Benton Visual Retention Test (Benton, 1963) and the Mariannene Frostig Developmental Test of Visual Perception (Frostig, et al, 1966). If perception is measured with such tools, the results may in fact be a reflection of a child's motor deficiencies rather than his perceptual inadequacies.

The purposes of this study were to determine the difference in performance between children with cerebral palsy and normal children in each of two visual perception tests which were the Motor-Free Visual Perception Test (MVPT) as a motor-free test and the Mariannene Frostig Developmental Test of Visual Perception (DTVP) as a motor-involved test. A second purpose was to compare the difference in these two tests in two cerebral palsy subgroups who were divided into diplegia and quadriplegia and a group of normal children.

It was hypothesized that, first: the group with CP would obtain significantly lower scores than the normal control group in each test and second: that while there would be no significant difference between the two tests results in the normal group, there would be a significant difference in the quadriplegic CP group.

Methods

Subjects

The CP group consisted of 21 children: 10 were diplegic and 11 were quadriplegic. Eight normal children were used as the control group. The availability of subjects who met the criteria for this study was limited. Only subjects with a MVPT perceptual quotients (PQ) greater than 85 were accepted.

Chronological age for all groups ranged from 4 to 8.5 years with means of 5.5 for the control group, 6.5 for the diplegic group, and 6 years for the quadriplegic group. There were slightly more males than girls in the CP group (Table 1). All CP children had a confirmed medical diagnosis of diplegia or quadriplegia and were receiving treatment for cerebral palsy either at one of two rehabilitation facilities or at a university hospital at the time of this study. All the facilities involved were located in central Korea.

Table 1. Subject characteristics

Characteristics	Normal (n=8)	Cerebral Palsy	
		Quadriplegia (n=11)	Diplegia (n=10)
Chronological Age (month) Mean±SD (range)	68.4±15.7(48~99)	72.6±17.5(52~105)	81.2±18.1(51~104)
Gender (n/%)			
Male	4(50.0)	8(72.7)	6(60.0)
Female	4(50.0)	3(27.3)	4(40.0)
Handedness (n/%)			
Right	7(87.5)	5(45.5)	10(100.0)
Left	1(12.5)	6(54.5)	0(0.0)

Instruments

The Motor-Free Visual Perception Test (MVPT) is a test of "visual perception that avoids motor involvement and is suitable for screening, diagnostic assessment and research purposes" (Colarusso and Hammill, 1972). There are 36 multiple-choice designs that evaluate 5 types of visual perception skills: visual discrimination (the ability to discriminate dominant features in different objects), spatial relationships (the ability to orient one's body in space and to perceive the position of objects in relationto oneself and to other objects), figure-ground relationships (the ability to distinguish an object from its background), visual closure (the ability to identify an incomplete figure with only fragments are present), and visual memory (the ability to recall dominent features of one stimulus item or to remember the sequence of several items). The MVPT has been standardized on 881 children, ages 4 to 8 in the United States but not yet in Korea. Test-retest reliability ranges from .77 to .91: split-half reliability ranges from .81 to .88.

The Mariannene Frostig Developmental Test of Visual Perception (DTVP) is designed to identify disturbances of visual perception contributing to disabled or disturbed children. It is useful in diagnostic batteries, as a screening test, and as a guide to suggest areas and methods of treatment for the perceptually impaired child. This test consists of five relatively distinct subtests: eye-motor coordination, figure-ground, constancy of shape, position in space and spatial relation ships, each requiring the subject to draw and check items manually in the test booklet. The DTVP has been standardized on a large sample of normal nursery and school children, ages 3 to 9 in the United States. This also has yet to standardized in Korea. Test-retest reliability is .98 and split-half reliability ranges from .78 to .89 (Asher, 1988; Breger, 1968; Frostig et al, 1966).

Test Procedure

The MVPT and the DTVP were individually administered to each subject in the standardized manner described in each test manual (Colarusso and Hammill, 1972; Frostig et al, 1966). Each subject was seated while

taking the test, with the test plates lying flat on a table placed diretly in front of the child. The subject answered the test questions by pointing to one of four alternatives in the MVPT booklet and by drawing and checking the answers in the DTVP test booklet. The raw scores on both tests were converted to perceptual ages (PA) and perceptual quotients (PQ). Analysis of the data was done by use of the Wilcoxon signed rank test, the Mann-Whitney and the Kruskal-Wallis. A p-value of .01 was set for significance of the results.

Results

It was hypothesized that the CP group would obtain significantly lower scores than would the control group. Therefore, the Mann-Whitney test was used to determine if there was significant a perceptual quotient difference between the two main groups in each of the two tests. The median, range, U score, and Probability for the control and CP group in the MVPT and the DTVP are presented in Table 2. There were significant differences in perceptual quotients between the control and the CP group in the MVPT and in the DTVP.

In the control group of normal children, the perceptual age (PA) was greater than the chronological age (CA) in all but two groups. Conversely, in the CP group the comparison of perceptual age and chronological age was different according to subgroup and test. These differences were calculatedstaistically with the Kruskal-Wallis. There ere significant differences among control, diplegia, and quadriplegia groups in eachest. But there was no significant difference between the two CP subgroups in each test (Table 3).

Table 2. Difference between perceptual quotient for two groups in both tests

	Normal	Cerebral Palsy	U	p
MVPT† Median (range)	107.0(93, 133)	91.0(60, 116)	34.5	.010
DTVP‡ Median (range)	117.0(94, 137)	76.0(50, 118)	6.0	.000

†Motor-Free Visual Perception Test.
‡Mariannene Frostig Developmental Test of Visual Perception.

Table 3. Chronological age (CA) and perceptual age (PA) differences between the diplegia and the quadriplegia groups across two tests

	Diplegia	Quadriplegia	U	p
MVPT† Median (range)	9.5(-16, 24)	12.0(-11, 36)	50.0	.72
DTVP‡ Median (range)	18.5(-9, 43)	26.0(0, 44)	45.0	.48

†Motor-Free Visual Perception Test.
‡Marianne Frostig Developmental Test of Visual Perception.

When comparing the normal and quadriplegia groups there was no significant chronological age minus perceptual age (CA-PA) difference between two groups in the MVPT, but there was in the DTVP (Table 4).

The second hypothesis was that while the normal group would have no difference between two tests, the quadriplegia group would. The Wilcoxon signed rank test was used to identify the MVPT-DTVP difference in each group. The chronological age minus the perceptual age (CA-PA) totals were used for the analysis. The results showed that no significant difference between the two tests in the normal and the diplegic groups, but did show a significant difference between two tests in the quadriplegic group (Table 5).

Table 4. Chronological age (CA) and perceptual age (PA) differences between the normal and the quadriplegia groups across two tests

	Normal	Quadriplegia	U	p
MVPT† Median (range)	-7.5(-34, 7)	12.0(-11, 36)	16.5	.023
DTVP‡ Median (range)	-4.5(-22, 7)	26.0(0, 44)	3.0	.000

†Motor-Free Visual Perception Test.

‡Marianne Frostig Developmental Test of Visual Perception.

Table 5. The chronological age minus the perceptual age (CA-PA) differences between two tests across three groups

	MVPT†	DTVP‡	Z	p
Normal Median (range)	-7.5(-34, 7)	-4.5(-22, 7)	-0.52	.612
Diplegia Median (range)	9.5(-16, 24)	18.5(-9, 43)	-2.49	.013
Quadriplegia Median (range)	12.0(-11, 36)	26.0(0, 44)	-2.93	.003

†Motor-Free Visual Perception Test.

‡Marianne Frostig Developmental Test of Visual Perception.

Discussion

A perception is the manner in which we take in information from the environment and from our own bodies through the senses. The information is then processed and the sensory impressions interpreted and identified according to what has been previously learned

and experienced (Frostig and Horne, 1964; Strauss and Lehtinen, 1947). In the developing child, there is a systematic increase in the ability to perceptual analysis and discriminate objects. Although disturbed visual perception often accompanies cerebral damage, one may not conclude from this that 1) all patients with cerebral damage have disordered visual perception, or that 2) the functional inadequacies exhibited by cerebrally damaged persons on tasks demanding visual discrimination may automatically be interpreted in terms of a presumed disturbance in visual perceptual functioning (Bortner and Birch, 1962)

Early research indicated that the degree of perceptual impairment in person with CP was related to the type of CP and the severity of the motor impairment (Abercrombie, 1964; Brich, 1964). It is logical to think that the various motor disorders found in the subtypes of CP are caused by different brain lesion, other than right/left hemisphere, to perceptual or perceptual-motor functions (Hardy, 1983; Menkes, 1980; O'Reilly and Walentynowicz, 1981). In many studies which purported to assess visual perception used evaluations that required a skilled motor responsed (Bortner and Birch, 1962; Newcomer and Hammill, 1971). In the study by Menken and Cermark (1987) suggested that the Test of Visual-Perceptual Skills to be a useful tool in evaluating visual perception in CP as a motor-free test.

The results of this study support the first hypothesis that CP will obtain significantly lower scores than normal children in each test. All but the CP group fell more PQ in the DTVP than in the MVPT, the normal control did not. The second hypothesis also support that while the normal group would have no difference between two tests, the quadriplegia group would in this study.

This study indicated that the MVPT may be useful evaluation tool for children with cerebral palsy. However, because of the small number of cerebral palsy subjects used in this study, the results may not be indicative of visual perceptual functioning in all cerebral children.

Conclusion

The MVPT appears to be a valid assessment of visual perceptual deficits for children with cerebral palsy and can be used for identifying and screening visual perceptual deficits in quadriplegic type CP children. The DTVP does not.

The results were as follows:

1. Children with cerebral palsy showed significantly lower perceptual quotients (P Q) in the MVPT ($p<.01$) and the DTVP ($p<.01$) when compared with normal children.

2. In normal children no significant the chronological age minus the perceptual age (CA-PA) differences between the MVPT and the DTVP were found.

3. In the diplegic group there was no significant the chronological age minus the perceptual age (CA-PA) differences between the MVPT and the DTVP groups ($p>.01$).

4. In the quadriplegic group there was a significant the chronological age minus the perceptual age (CA-PA) differences between the MVPT and the DTVP groups ($p<.01$).

This study would be strengthened by increasing the number of subjects studied. Continued research are needed to identify a visual perceptual ability according to the

severity of motor disability in the children with cerebral palsy. And the other one is to examine visual perceptual development and self-care functioning in the CP group.

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