Visual acuity and behavior in people with severe motor and intellectual disabilities

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Abstract. The authors examined the relationship between visual acuity and daily behavior in people with severe motor and intellectual disabilities (SMIDs). The visual acuity of 15 subjects was assessed using two methods: Teller Acuity Cards and the STYCAR balls vision test. The subjects' caregivers evaluated the subjects' daily behavior and completed a questionnaire. Results implied that visual acuity and behavior were correlated.

Keywords: Visual acuity; Severe motor and intellectual disability; Teller acuity card; STYCAR balls vision test

1. Introduction

It has been reported that evaluations of visual function are difficult in individuals with severe motor and intellectual disabilities (SMIDs) because they tend to show little or no interest in visual stimuli [1,2,3]. For that reason, even parents and caregivers tend to be uncertain whether or not their child or patient can see. This study is intended to examine the relationship between visual acuity and daily behavior related with vision in people with SMIDs.

2. Methods

2.1 Subjects

Eight females and seven males, 11–42 years of age, served as subjects for this study. All 15 subjects were patients in a special care unit for SMID in a hospital. They all had profoundly severe intellectual disabilities as well as motor disabilities.

Their developmental ages were estimated by Enjoji's Infant Analytic Development Test [4], which assesses the developmental age of infants from six aspects (Table 1). In addition, using Oshima's classification [5], which has been much used for defining the

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degree and situation of SMID in Japan, they were classified in region classes of 1 or 2 (bedridden or able to sit alone with IQ less than 20).

Table 1
Developmental ages (month).

Physical Movement		Sociality		Language	
Body or head	Hand	Activity of daily living	Personal relations	Expression	Comprehension
1–9	0–9	2–28	2–17	3–28	0–34

2.2 Procedure

Visual acuity was assessed using Teller Acuity Cards (TAC) produced by Vistech Consultants, Inc. and STYCAR balls vision tests (ST) produced by nferNelson.

TAC is based on a forced-choice preferential looking procedure. A blank card was shown to each subject from 38 cm. The observer waited until the subject looked at the card (sometimes the observer called to the subject and moved a toy in front of the subject to attract attention when he or she did not become aware of the card). Then the observer presented a card with gratings that were presented arbitrarily either to the right or left part of the card. The observer was blind to the location of the grating and judged the location according to the participant's eye movements. First, a card with a low spatial frequency was used. The next card was presented if the observer judged that the subject looked at the grating. They were shown in order of increasing spatial frequency. For each card, trials were conducted three times at most.

A set of graded white balls is used in the ST test; they are 0.125–2.5 inches in diameter [6,7]. A ball was presented 38 cm in front of a subject's face in front of a dark background. Two observers checked the gaze fixation and followed the subject's eye movements. The next ball was presented if the observer judged that the subject looked at the ball. Balls were shown in order of decreasing size. The ball's distance from the face was increased if a subject looked at the smallest ball.

In the assessment, the order of TAC and ST was randomized for the subjects. As basic visual functions, blink reflex and visual tracking for the light and ball were observed before the assessment.

Concerning daily behavior of the subjects, caregivers that worked with the subjects in a special care unit were asked to fill out a questionnaire that included five questions (Table 2). They answered according to a Likert scale of three stages (1 = many, 2 = sometimes, 3 = unknown).

Table 2
Questionnaire on daily behavior.

a. Does the subject look at a face of a person?
b. Does the subject follow the movement of a face of person?
c. Does the subject follow the movement of persons and goods?
d. Does the subject look at a toy?
e. Does the subject follow the movement of a toy?

3. Results and Discussions

Blink reflex and visual tracking for the light and ball were observed in 12 subjects, but not in 3 subjects (Subjects 11, 14, 15).

In an assessment, visual acuities of four subjects by TAC and three subjects by ST could not be assessed because they showed no response for cards or balls. Among them, two subjects could not be assessed by either method. The ranges of visual acuity of the subjects were 0–0.22 by TAC and 0–0.189 by ST. Correlation analysis (Pearson's product moment correlation coefficient) using SPSS 11.0J for Windows (SPSS Inc.) revealed a significant correlation between values of TAC and ST ($r=0.554$, $p<0.05$).

Daily behaviors of the subjects were categorized to the following three types. Type 1: all answers were 1 (6 subjects); Type 2: Mixture of 1 and 2 (4 subjects); Type 3: All or most answers were 3 (5 subjects). In the Type 3 subjects, visual acuities were in the lowest category (under 0.01 by both methods) compared with those in other two types (Table 3).

These results implied that visual acuities by the two methods and caregivers' evaluation of behavior were correlated.

Table 3
Subjects' profiles and results.

			Visual acuity		Daily behavior[a]				
Subject	Age	Main diagnosis	TAC	ST	a	b	c	d	e
1	35	Epilepsy	0.056	0.104	1	1	1	1	1
2	41	Cerebral palsy	0.056	0.094	1	1	1	1	1
3	32	Cerebral palsy	0.056	0.036	1	1	1	1	1
4	31	Mental retardation	0.056	0.002	1	1	1	1	1
5	20	Menkes disease	0.03	0.036	1	1	1	1	1
6	11	Cerebral palsy	0[b]	0.036	1	1	1	1	1
7	38	Cerebral palsy	0.22	0.003	1	1	2	1	1
8	33	Cat cry syndrome	0.03	0.006	1	1	1	1	2
9	42	Epilepsy	0.22	0.189	1	1	2	1	2
10	29	Sanfillipo syndrome	0.03	0.012	1	1	2	1	2
11	17	Cerebral palsy	0.005	0[b]	1	3	3	3	3
12	28	Mental retardation	0[b]	0.004	3	3	3	2	3
13	26	Hydrocephalus	0.005	0.002	3	3	3	3	3
14	27	Hydranencephaly	0[b]	0[b]	3	3	3	3	3
15	16	Septo-optic dysplasia	0[b]	0[b]	3	3	3	3	3

[a]1 = many, 2 = sometimes, 3 = unknown (Questionnaire is shown in Table 2). [b]No response.

4. Conclusion

This study examined the relationship between visual acuity and daily behavior in people with SMIDs. Assessments of 15 subjects' visual acuity by two methods and evaluation of their daily behavior by caregivers implied that visual acuity and behavior were correlated.

On the other hand, in type 1 of daily behavior, we were unable to assess visual acuity for one subject, whereas we were able to assess visual acuity by both methods in another subject in type 3 of daily behavior. In addition, it was impossible to assess visual function for two subjects. Further research is needed to evaluate visual function for such

people with SMIDs. Especially, we would like to examine the use of other methods such as electrophysiological methods [8].

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