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Relationship between medical examination methods and actual conditions of life for preserving visual acuity in primary and junior high school

-Verification of the current vision test-

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The deterioration of children's eyesight is on the rise. Children's lives have changed in a short period of time, such as an increase in blue light due to the use of electronic devices. It is necessary to consider non-traditional content of health guidance for prevention. The accurate visual acuity test is important to examine the effects of visual acuity and environmental or living factors. We examined the accuracy of the visual acuity test with the three-stage Landolt ring for children from the relationship with the eye axial length.

After performing a normal detailed visual acuity test of the children and the correlation analysis with the eye axial length, we examined the distribution of the eye axis according to the results of the three-stage visual acuity test by the Landolt ring.

The number of children measured eye axial length was 13. The correlation coefficient between detailed visual acuity test and eye axial length was negative. According to the results of the three-stage visual acuity test, the distribution of the eye axis is good for the right eye: the average eye axis of "A" was 23.44 mm, moderate: the average of "B" was 22.58 mm. The average of the left eye axis for "A" children is 23.34 mm, for "B" is 23.08 mm, and for "C" is 23.7 mm.

The correlation coefficient between the detailed visual acuity test and the eye axial length was negative on both sides, namely a negative correlation between the visual acuity and the eye axial length. There was a possibility of not correspondence between the three-stage visual test and the eye axial length. In the case of children, it was considered that their visual performance and answers were different because of their mood and physical condition on the day.

1. Introduction

Recently, deterioration of eyesight of students has become a problem. The prevalence of mobile phones and tablet devices. Is thought to affect the eyesight of growing children. [1)] We have many occasions to stare at fine things closely in modern life. The main reason for weakness of children's eyesight is myopia. Personal computers and tablet devices have been introduced to classes. Children's ability to use computers has become an ability that society expects children to have. Group

education was stopped to prevent infection and the Internet was used for home study. Since many people have confirmed the convenience of computers and tablet devices, the use of electronic devices will become more widespread. It is necessary to change the health guidance to keep good eyesight.

It is essential for us to collect information visually in modern daily life. The use of eyeglasses during childhood limits our daily life. The risk of injury from eyeglasses increases at the time when children do exercise. They say that becoming myopia at the early stage comes to severe myopia easily. The risk of glaucoma and retinal detachment increases. Therefore, it is desirable to prevent the deterioration of eyesight as much as possible. However, the work of seeing closely is unavoidable in our daily life. If you can find the initial to the signs of visual acuity lowering, prevention effect of vision loss will be enhanced. However, it is said that the actual vision condition is difficult to grasp because the visual acuity test at school is a subjective test.

We focused on 4th grade elementary school students, because their vision is subject to become worse in the 4th~5th grade. Moreover, we centered on myopia which is considered as a cause of bad eyesight commonly. Previous studies have pointed out the relationship between sleep, exercise, and poor eyesight. It is also considered to be an adverse effect caused by a decrease in sleep and exercise time due to an increase in time spent for learning and video games. Visual acuity and lifestyle are closely related.

In order to clarify the lifestyle which affects visual acuity and to prevent myopia, it is necessary to measure visual acuity accurately. Therefore, in this study, in addition to previous studies, we introduced the eye axial length measurement with the cooperation of an ophthalmologist in order to comprehend the exact state of visual acuity. The purpose is to examine the association with the three-stage test in school medical examination.

2. Method

It is necessary to consider different life styles for health guidance for children's visual acuity and prevention. Therefore, we first conducted a questionnaire survey to clarify the actual conditions of children's eyesight and lifestyle. The questions are basic attributes, video / game / mobile phone / computer usage time, sleep time, study time, and exercise.Visual acuity and axial length were measured too. The visual acuity test was conducted in May 2020. We conducted the correlation analysis between normal visual acuity test and the eye axial length. Next, we examined the distribution of the eye axis, which was separated from the results of the three-stage visual acuity test by Landolt ring. Statistical analyses were performed by IBM SPSS Ver25 for windows.

3. Result

Questionnaires were distributed to 62 fourth graders in the study, and responses were obtained from 61. The genders of the respondents were 33 males (54.1%) and 28 females (45.9%). Males and females were also analyzed because there was no significant association between visual acuity and gender. The relationship between visual acuity and lifestyle is shown in Tables.

Table 1. Relationship between gender and visual acuity

		Visual acuity					
		Good	(%)	Not good	(%)	Total	(%)
Gender	Male	14	42.4	19	57.6	33	100
	Female	11	39.3	17	60.7	28	100

Table 2. Relationship between life styles and visual acuity

Life styles		Visual acuity				
		Good	(%)	Not good	(%)	p-value
Presence or absence of cram	2 days less / week	10	40.0	24	66.7	0.004
	3 days more / week	15	60.0	12	33.3	
Reading volume	2 books less / month	16	64.0	19	52.8	0.383
	3 books more / month	9	36.0	17	47.2	
Exercise frequency	1 to 3 days / month	10	40.0	16	44.4	0.730
	1-2 days more / week	15	60.0	20	55.6	
Exercise time	Less than 1 hour / day	10	37.5	15	45.5	0.548
	1 hour or more / day	15	62.5	18	54.5	
Illuminance at bedtime	No lighting	14	56.0	14	38.9	0.187
	Yes	11	44.0	22	61.1	

Table 3. Relationship between using electric equipment and visual acuity

Use of electronic equipment		Visual acuity				
		Good	(%)	Not good	(%)	p-value
TV viewing time (weekdays)	Up to 1 hour	10	40.0	13	36.1	0.758
	1 hour or more	15	60.0	23	63.9	
TV viewing time (holiday)	Up to 1 hour	5	20.0	7	19.4	0.957
	1 hour or more	20	80.0	29	80.6	
Game time (weekdays)	Up to 1 hour	16	64.0	24	66.7	0.829
	1 hour or more	9	36.0	12	33.3	
Game time (holiday)	Up to 1 hour	10	40.0	20	55.6	0.232
	1 hour or more	15	60.0	16	44.4	
PC usage time (weekdays)	Up to 1 hour1	19	76.0	27	77.1	0.918
	1 hour or more	6	24.0	8	22.9	
PC usage time (holiday)	Up to 1 hour1	19	76.0	22	61.1	0.223
	1 hour or more	6	24.0	14	38.9	

Table 4. Relationship between sleep and visual acuity

How to feel sleep		Visual acuity			
		Good	(%)	Not good	(%)
Sleeping status	Good	22	88.0	35	97.2
	Not good	3	12.0	1	2.8
Night awakening	Good	25	100.0	36	100
	Not good	0	0.0	0	0
Mood when waking up	Good	25	100.0	35	97.2
	Not good	0	0.0	1	2.8
Time of sleeping	Good	24	96.0	34	94.4
	Not good	1	4.0	2	5.6
Satisfaction of sleep	Good	24	96.0	33	91.7
	Not good	1	4.0	3	8.3
Daytime mood	Good	25	100.0	36	100
	Not good	0	0.0	0	0
Daytime activities	Good	25	100.0	36	100
	Not good	0	0.0	0	0
Daytime sleepiness	Good	25	100.0	35	97.2
	Not good	0	0.0	1	2.8

The number of children measured eye axial length is 13. The correlation coefficient between detailed visual acuity test and the eye axial length was -0.081 for right eye and -0.295 for left eye. There is no significant difference. The visual acuity “A” of the right eye was 10, “C” was 2.

The figure shows the distribution of the eye axis according to the results of the three-stage visual acuity test (Figure 1). “A”, which is the right eye has good visual acuity, had an axial mean of 23.44 mm. “B”, which is moderate visual acuity had an axial mean of 22.58 mm. The visual acuity A of the left eye was 10 children, “B” was 2, and “C” was 1. The mean for “A” children was 23.34 mm, for “B” was 23.08 mm, and for “C” was 23.7 mm. The mean of the axial length for an adult is about 24 mm. The Japanese orthoptist started in 2001 If it's about 24 mm, an average of adult's ocular shaft length is recorded according to the degree of refraction in the nearsightedness "and" consideration of ocular shaft length in the society magazine. [2)]

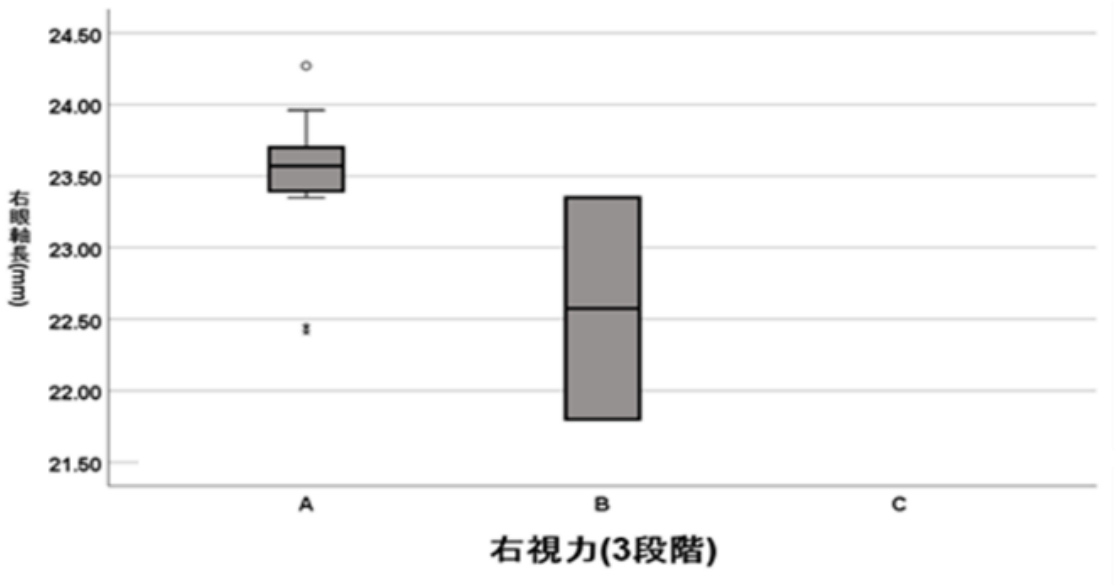

Figure 1-1. Distribution of axial length by visual acuity (right eye)

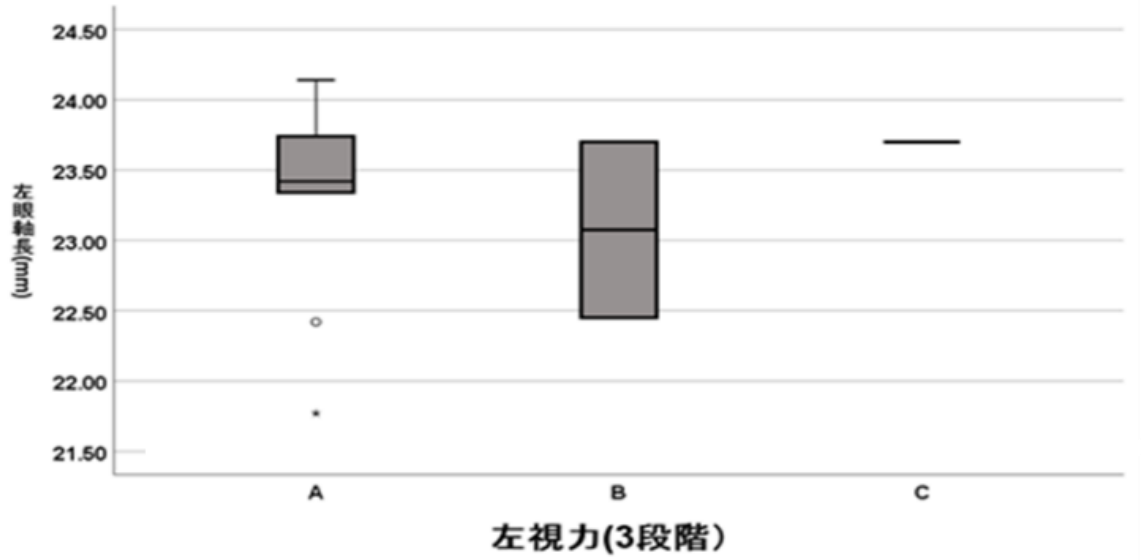

Figure 1-2. Distribution of axial length by visual acuity (left eye)

4. Achievements and issues

In the situation where myopia is increasing, accurate visual acuity tests are important for early determination of the effects of environmental and lifestyle factors such as radiation and blue light, and for evaluating the effect of myopia prevention. However, school screenings have used a three-step method, called the 370 method, for screening because of the influence on the learning and the inspecting for many children in a short time. The criteria listed below. [3)]

Children of "A" (1.0 or higher) can easily read the letters on the blackboard, even from the back seat of the classroom.

"B" (0.7-0.9) children can read most of the letters on the blackboard in the back seat of the classroom.

“C” (0.3-0.6) children can read only about half of the small letters in the seats in front of the center. “D” (0.2) can't read letters clearly without the glasses even if they sit in the front seat.

In the lower grades of elementary school, if the result of the visual acuity test is 0.7 with both eyes, it is said that the children can see the letters on the blackboard at any seat in the classroom. From upper grades to junior high school students and above, the visual acuity test with both eyes of 1.0 or higher is desirable. As the visual acuity affects learning, it is stipulated by the School Health and Safety Law and regular visual checkups are conducted.

Depending on the results of the three- stage visual acuity test, a child will be examined by an ophthalmologist for detailed examination. Before considering life-style habits which affects visual acuity, it is necessary to examine the accuracy of the three-stage visual acuity test. We examined the accuracy of the visual acuity test by the three-stage Landolt ring for children by the relationship with the eye axial length.

In general, it is said that the worse the detailed vision test is, the longer the eye axial length is. Similarly, in this study, the detailed vision test results and the correlation coefficient of the eye axial length were negative both the right eye and left. On the other hand, in the three-stage visual acuity test, the visual axis of children with good visual acuity was long. It was suggested that the three-stage visual acuity test and the eye axial length may not match. It is possible that the children's visual performance may differ from depending on the mood of the day and physical condition, and the answers may not be constant.

In the school screenings, the three-stage test is considered to be appropriate in view of the time required, because the screening is performed based on the blackboard visibility. However, parents do not have their children see the ophthalmologist unless the abnormality in the eyes is found, such as swelling or pains. If the visual acuity test at school is “B”, and if it is at the boundary with “C”, their deterioration of eyesight is easily overlooked. This study had a small number of children measured by the effects of school closure due to Covid-19. It is necessary to increase the number of children by continuing the measurement of the eye axial length in the future, and to examine the relationship between their life and the results of detailed visual acuity tests.

References

1) Bun bukagakushō: Ryō Kazu moto nendo gakkō ni okeru kyōiku no jōhō-ka no jittai-tō ni kansuru chōsa kekka. Heisei 31-nen 3 tsuki.

2) Miya Tomomi, Asano Haruko, Kodama Shiyūhei: Kinshi ni okeru kussetsu-do to me-jiku-chō no kentō. Nihon shinōkunrenshi kyōkai-shi. Dai 29-kan. 2001.

3) school health care safe way: April 10, 1958

Questionnaire

1. For the next question, please circle the applicable number.

A2	Please tell me your gender
	1. Male 2. Female
A3	Do you have family members wearing glasses or contact lenses (please answer with your child's relationship)?
	1. Yes (who?) 2. No
C7	Do you go to a cram school (including Keiko)?
	1. Not done 2. Go 1-2 days a week 3. Go 3-4 days a week 4. Go more than 5 days a week
C12	How many books do you read in a month (excluding textbooks, reference books, manga and magazines)?
	1. I don't read even one book 2. 1-2 books 3. 3-4 books 4. 5 or more
C8	How much exercise or sports do you do outside of school or physical education (eg swimming, soccer classes, etc.)
	1. Almost not 2. 1-3 days a month 3. 1-2 days a week 4. 3 days or more a week
C9	How long do you spend a day exercising or playing sports (excluding physical education classes at school)?
	1. Up to 30 minutes 2. From 30 minutes to 1 hour 3. From 1 to 2 hours 4. 2 hours or more

2. How long have you used the following for the past month?

Please circle the applicable number. If you are not using it, please circle ' 1.'

Monday to friday

B1	TV, video
	1. Almost never 2. Up to 1 hour 3.1 to 2 hours 4.2 to 3 hours 5.3 hours or more
B3	Game console (mobile phone)
	1. Almost never 2. Up to 1 hour 3.1 to 2 hours 4.2 to 3 hours 5.3 hours or more
B7	PC (including Internet, games, and tablet PC)
	1. Almost never 2. Up to 1 hour 3.1 to 2 hours 4.2 to 3 hours 5.3 hours or more

Holidays such as Saturday and Sunday

B1	TV, video
	1. Almost never 2. Up to 1 hour 3.1 to 2 hours 4.2 to 3 hours 5.3 hours or more
B3	Game console (mobile phone)
	1. Almost never 2. Up to 1 hour 3.1 to 2 hours 4.2 to 3 hours 5.3 hours or more
B7	PC (including Internet, games, and tablet PC)
	1. Almost never 2. Up to 1 hour 3.1 to 2 hours 4.2 to 3 hours 5.3 hours or more

3. I would like to ask you about your life over the past month. Please circle the applicable number.

About Monday to Friday

C3	How long do you read at home or in the library per day (including textbooks, reference books, manga and magazines)?
	1. Up to 1 hour 2. From 1 hour to 2 hours 3.2 hours to 3 hours 4.3 hours or more
C5	How long do you study at home (including school homework and cram school)
	1. Up to 1 hour 2. From 1 hour to 2 hours 3.2 hours to 3 hours 4.3 hours or more
C10	How many days out of 5 days do you play outside (at school breaks, at home, etc.)?
	1. No 2.1-2 days 3.3 days 4.4 days or more
C10	How much time do you play outside (at school breaks, at home, etc.) per day?
	1. No 2. Up to 30 minutes 3. From 30 minutes to 1 hour 4.1 to 2 hours 5.2 hours or more

About holidays such as Saturday and Sunday

C4	(Holiday) How long do you read at home or in the library per day (including textbooks, reference books, manga and magazines)?
	1. Less than 1 hour 2. From 1 hour to 2 hours 3.2 hours to 3 hours 4.3 hours or more
C6	(Holiday) How long do you study at home (including homework at school and cram school)?
	1. Less than 1 hour 2. From 1 hour to 2 hours 3.2 hours to 3 hours 4.3 hours or more
C11	(Holiday) How long do you play outside?
	1. No 2. Less than 1 hour 3.1 to 2 hours 4.2 to 3 hours 5.4 hours or more

4. Please select the ones you have experienced at least 3 times a week in the past month and mark one.

D1	How was the time between lying down and going to sleep?
	1. I slept immediately 2. It took a little longer than usual
	3. It took much longer than usual 4. It took much longer than usual

D2	Did you ever wake up during sleep at night?
	1. It wasn't a problem 2. I had a little trouble
	3. I was in a lot of trouble 4. I was in a serious condition or couldn't sleep at all
D3	Have you ever woken up earlier than your desired wake-up time?
	1. It wasn't like that 2. It was a little early
	3. It was pretty early 4. It was very early, I couldn't sleep at all
D4	Do you feel that your sleep is long enough?
	1. Enough 2. Slightly missing 3. Quite missing 4. Not at all
D5	Do you feel sleepy overall?
	1. Full 2. Feeling a little sleepless 3. Feeling quite asleep 4. Feeling very sleepless
D6	How was your mood during the day?
	1. It was normal 2. Feeling a little sick 3. Feeling quite sick 4. Feeling very sick
D7	Did you move and think as usual during the day?
	1. It was normal 2. I couldn't do it a little 3. I couldn't do it quite well 4. I couldn't do it very much
D8	Did you feel sleepy during the day?
	1. Not at all 2. There was a little 3. There was quite a lot 4. It was intense

5. Have you ever had something like the following in the past month?
Please circle the applicable number.

Question number	Question item	Not at all	rare	Sometimes	Common
E1	My head is dizzy	1	2	3	4
E2	Headache	1	2	3	4
E3	Feel heavy body	1	2	3	4
E4	Feeling sick	1	2	3	4
E5	Get tired easily	1	2	3	4
E6	Lonely	1	2	3	4
E7	sad	1	2	3	4
E8	Somehow, I feel scared	1	2	3	4
E9	I'm feeling down	1	2	3	4
E10	Somehow, I'm worried	1	2	3	4
E11	Frustrating	1	2	3	4
E12	Feeling, crumpled	1	2	3	4
E13	Grumpy and angry	1	2	3	4
E14	I want to hit someone	1	2	3	4

E15	Everything escaped	1	2	3	4
E16	I can't do my best	1	2	3	4
E17	I can't study	1	2	3	4
E18	I can't concentrate on anything	1	2	3	4
E19	I don't feel like doing anything	1	2	3	4
E20	I can't get the power from my body	1	2	3	4

6. Do you care about the following to prevent vision loss? Please circle the applicable number.

stion number	Question item	I don't care at all	I don't care too much	Sometimes care	Care well
F1	I try to take a break when studying or watching TV	0	1	2	3
F2	I try not to lie down and read a book	0	1	2	3
F3	I am doing gymnastics to relieve eyestrain	0	1	2	3
F4	When I sit down and study, I try to keep my posture straight	0	1	2	3
F5	When I read a book or watch TV, I try to brighten in the room.	0	1	2	3
F6	When I watch TV, I try to move away from the screen	0	1	2	3
F7	I decide the time to play smartphones and games	0	1	2	3
F8	I try to eat food that is good for my eyes	0	1	2	3
F9	Other things "Please feel free to fill in"				
	( )				