

Investigation of guidance on maintaining visual acuity at combined school from kindergarten to junior high school.

— Consideration of relationship between visual acuity and lifestyle —

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Abstract:

The negative effect of visual acuity for growing children led by widely use of IC device such as mobile phone is concerned today. Heavy use of electronic device such as PC in early age will bring poor visual acuity, and an inconvenience in exercise caused by wearing glasses. In this study, we used wearable device to search relations between daily lives of children and a decrease in vision in add to a preexisting questionnaire. Compared with the duration of watching TV and reading books of PVA(Poor visual acuity) and NPVA(Non poor visual acuity), PVA students were turned out to be using more time in doing, which supports previous studies. The relevance to visual acuity and sleep was clarified to be significantly shorter in NPVA in terms of nocturnal awakening, and also the average of a sleep and a deep sleep duration were longer in NPVA. No significant difference was observed due to the small parameter. From now on, the further work is needed to examine child's sleep conscientiously, including enriching health guidance for sight maintenance.

1. Introduction

The negative effect of visual acuity for growing children led by widely use of IC device such as mobile phone is concerned today. However, more and more schools use IC device including personal computer (PC) and tablet terminal in classes. In addition, IC device is widely used in Japan, and the number of having and using smartphone is over 70%. This trend shows visual information have a great importance for gathering[collecting] information in daily life today.

In the contrast, heavy use of electronic device such as PC in early age will bring poor visual acuity, and an inconvenience in exercise caused by wearing glasses. Therefore, it is very important to prevent decreasing in vision. Previous studies have been reported that there was a relation among sleeping, exercise and a decrease in vision. In addition, it has been reported that the negative effects of lack of a sleep and exercise are caused by spending time on study and playing games. Also, there is a discussion about the relation between quality of sleep and a decrease in vision. On the other hand, to preserve enough time on⇒to sleep and exercise are not easy for children today. However, increasing sleep duration will make children get higher probability of keeping from decreasing in vision.

In this study, we used wearable device (Note 1) to search relations between daily lives of children and a decrease in vision in add to a preexisting questionnaire. We focused on observing progress of 4th grade students, because previous study has been reported that most students tend to have a decrease in vision among grade 4 to 5 in elementary school.

In this study, we define “poor visual acuity (PVA)” as one with low vision less than 0.1 for uncorrected eyes.

Note 1: Wearable device is an equipment that can measure the time and quality of exercise and sleep, by wearing on the wrist.

2. Method

We concentrated on 63 fourth grader students. We measured quality of a sleep by using wearable device, taking a count of a survey of the current living condition and the result of the visual acuity examination of the health check.

The results were linked by the same child, and we divided into 2 groups; Non poor visual acuity (NPVA) and Poor visual acuity (PVA), by the levels of visual acuity.

(* We define as “NPVA” and “PVA” on this paper.)

Note 2 visual acuity classification:

A: Unaided visual acuity is classified to be 1.0 or more in both eyes.

B: Unaided visual acuity is classified to be 0.9 to 0.7.

C: Unaided visual acuity is classified to be 0.6 to 0.3.

D: Unaided visual acuity is classified to be 0.2 or less.

Non poor visual acuity (NPVA): A person whose unaided visual acuity is classified to be 1.0 or more in both eyes. Poor visual acuity (PVA): A person whose unaided visual acuity is classified to be less than 1.0 among the right and left eyes, or those who use eyeglasses or contact lenses.

3. Result

63 subjects, without a lack of the living survey and a sleep survey were analyzed. From visual acuity examination, 12 students were classified as A, and 51 were less than B. There was no significant difference in the results of the visual acuity test between boys and girls, so they were added up. (Table 1)

Table1. Sex per group

Visual acuity				Summation (%)
Sex		NPVA (%)	PVA (%)	
	Male	8(66.7)	23(45.1)	31(49.2)
	Female	4(33.3)	28(54.9)	32(50.8)
Summation (%)		12(100.0)	51(100.0)	63(100.0)

1) Daily lives of students

Parents of 54 out of 64 students (85.7%) use glasses. 27 students (42.7%) go to a cram school more than once a week. 32 students (54.2%) read more than 5 volumes of books per month, which was the most frequent. 42 (72.4%) students watch television for an hour or more on weekdays, and 23 students (38.3%) play the video game for an hour or more. 16 students (26.7%) use PC for over an hour. 37 students (61.7%) study more than an hour on weekdays. As for sleeping, 50 students (84.7%) fall asleep in a minute.

2) Relations between visual acuity and life style

5 students (55.6%) in NPVA and 37 students (75.5%) in PVA watch television for an hour or more on weekdays.

Table 2. Watching television time on weekdays per group

Visual acuity				Summation (%)
TV time on weekdays		NPVA (%)	PVA (%)	
	Less than 59 minutes	4(44.4)	12(24.5)	16(27.6)
	More than an hour	5(55.6)	37(75.5)	42(72.4)
Summation (%)		9(100.0)	49(100.0)	58(100.0)

Students who read books more than an hour on weekdays were 2 (18.2%) in NPVA, and 19 (39.6%) in PVA. The difference was significantly more in PVA on weekend ($p=0.044$). Students who read more than five volumes per month are 3 (30.0%) in NPVA, and 29 (59.2%) in PVA.

Table 3. Reading time on weekdays per group

Visual acuity				Summation (%)
Reading time on weekdays		NPVA (%)	PVA (%)	
	Less than 59 minutes	9(81.8)	29(60.4)	38(64.4)
	More than an hour	2(18.2)	19(39.6)	21(35.6)
Summation (%)		11(100.0)	48(100.0)	59(100.0)

Table 4 . Reading time on weekends per group

Visual acuity				Summation (%)
Reading time on weekends		NPVA (%)	PVA (%)	
	Less than 59 minutes	8(72.7)	18(36.7)	26(43.3)
	More than an hour	3(27.3)	31(63.3)	34(56.7)
Summation (%)		11(100.0)	49(100.0)	60(100.0)

Table 5 . Amount of reading on weekdays per group

Visual acuity				Summation (%)
Amount of reading on weekdays		NPVA (%)	PVA (%)	
	Less than 4 books	7(70.0)	20(40.8)	27(45.8)
	More than 5 books	3(30.0)	29(59.2)	32(54.2)
Summation (%)		10(100.0)	49(100.0)	59(100.0)

More than 60% students belonging to each groups were studying more than an hour on weekdays and weekend. Students who exercise for more than once a week were 4 (36. 4%) in NPVA, and 30 (61. 7%) in PVA. Students doing exercise more than an hour per a day were 4 (36. 4%) in NPVA, and 22 (48. 9%) in PVA. Students in PVA were doing more exercises than NPVA.

Table 6 . Frequency of exercise per group

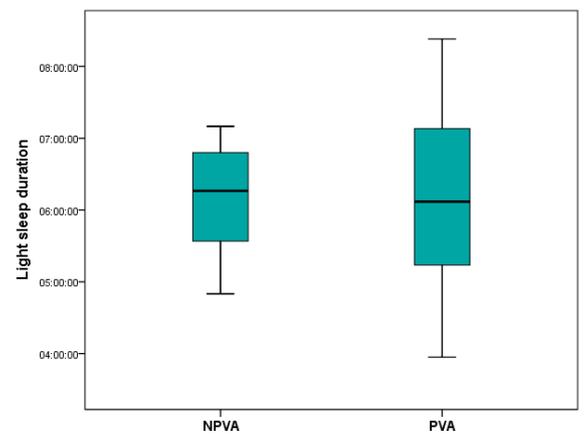
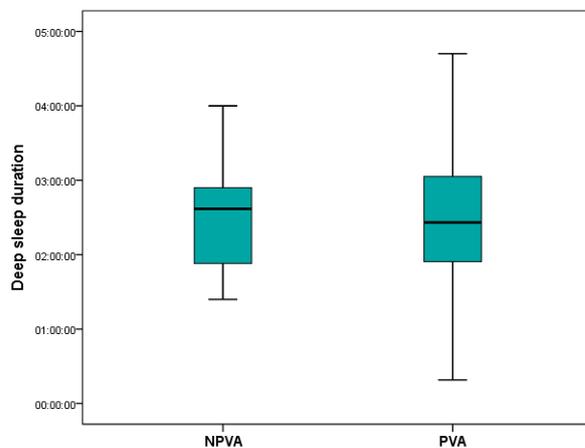
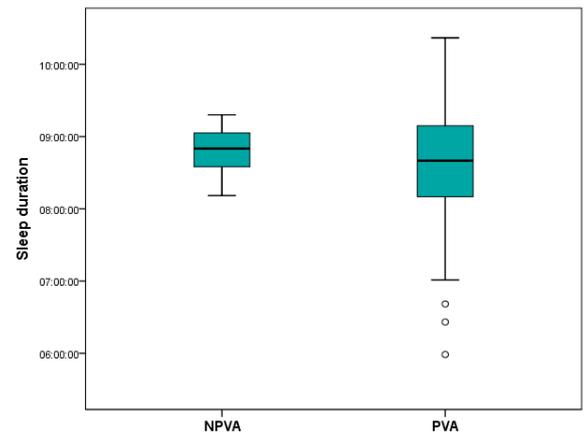
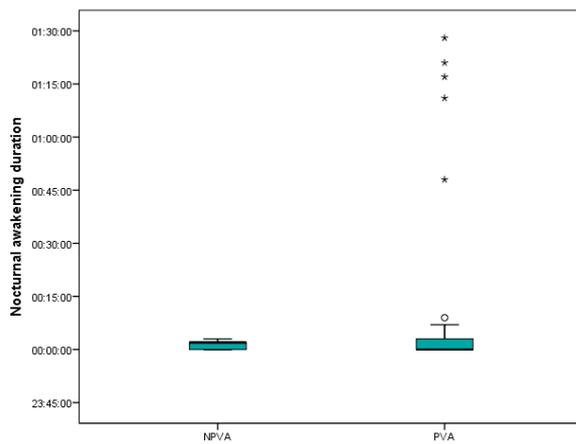
Visual acuity				Summation (%)
Frequency of exercise		NPVA (%)	PVA (%)	
	Rarely	5(45.5)	15(30.6)	20(33.3)
	More than once a week	6(54.5)	34(69.4)	40(66.7)
Summation (%)		11(100.0)	49(100.0)	60(100.0)

Table 7 . Exercise time per group

Visual acuity				Summation (%)
Exercise time		NPVA (%)	PVA (%)	
	Less than 59 minutes	7(63.6)	23(51.1)	30(53.6)
	More than an hour	4(36.4)	22(48.9)	26(46.4)
Summation (%)		11(100.0)	45(100.0)	56(100.0)

3) Relations between visual acuity and a sleep

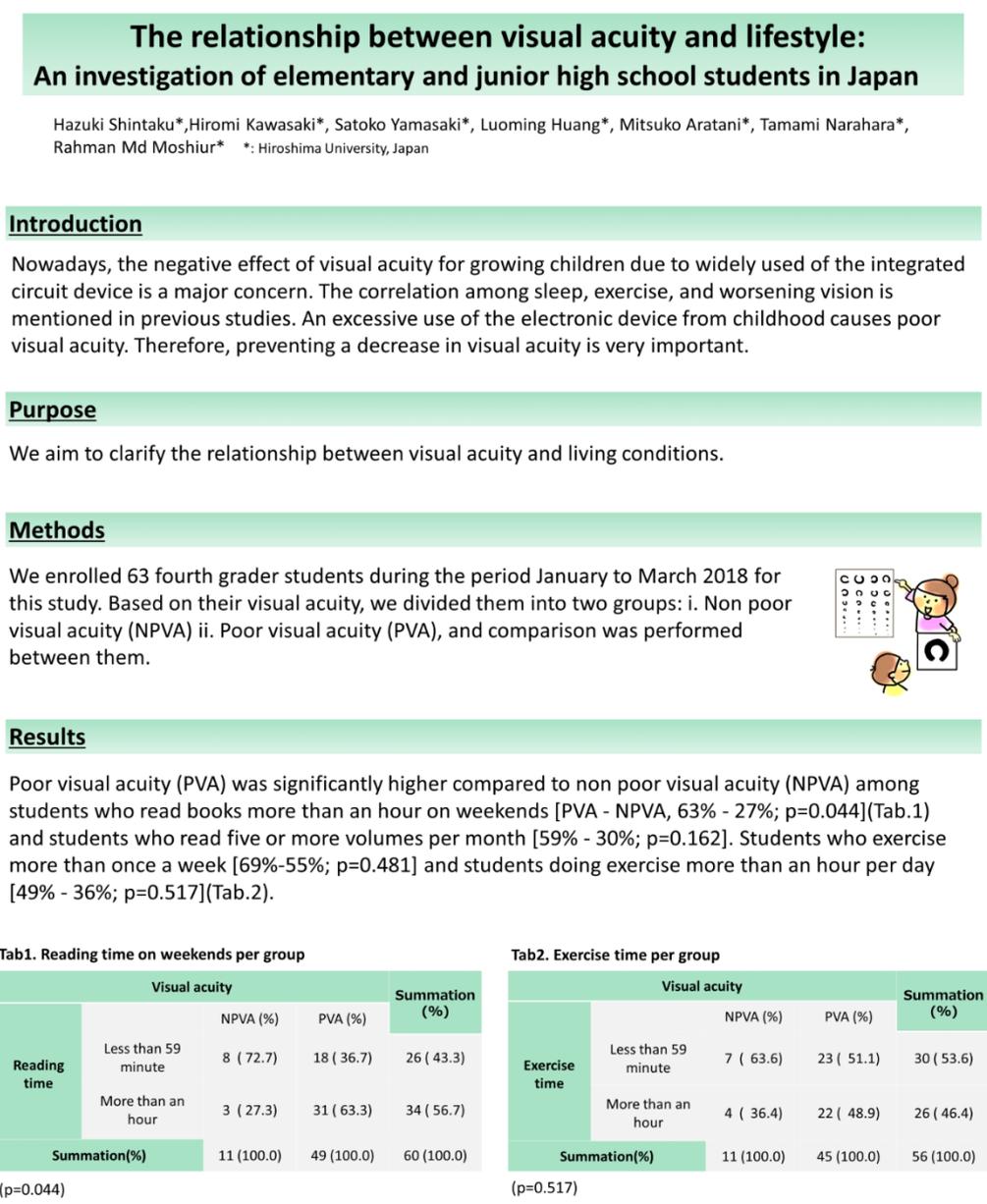
Both group students answered that there was a trouble in nocturnal awakening. Comparing the average duration of interrupted sleep, NPVA was 1 minute, PVA was 9 minutes, and the nocturnal awakening duration was significantly long ($p=0.03$). Individual variation in size of nocturnal awakening in NPVA was small, but 1 hour and 28 minutes the most difference in PVA.



The average of a sleep duration was 8 hours and 46 minutes in NPVA, and 8 hours and 33 minutes in PVA. The average of a deep sleep duration was 2 hours and 39 minutes in NPVA, and 2 hours and 26 minutes in PVA. The average of light sleep duration was 6 hours and 7 minutes in NPVA, and 6 hours and 8 minutes in PVA.

The consideration of preventing the decrease in visual acuity was 10.2 in NPVA and 12.83 in PVA ($p=0.048$). A significant consideration was turned out to be held in PVA.

Figure 「poster presentation」



Conclusion

Students who are doing study hard have less time to rest and taking care of eyes. Therefore, investigation of support is required. The correlation was not found despite the assumption of a relation between exercise and visual acuity, judging from the results. We should carry out a detailed study to find out the relations between exercise and visual acuity with increased parameter in the further.

3. Discussion

1) Daily lives of students

Judging from the survey of current living conditions, it was revealed that the frequency of using PC or tablet terminal is not high yet.

By the way, in general, watching TV and reading books play an important role in daily lives of students. As students move on to next grade, the more we should instruct how to use PC or tablet, consideration for visual acuity.

2) Relations between visual acuity and life style

In daily lives of students, a decrease in vision was thought to be associated with watching TV and reading duration. Compared with the duration of watching TV and reading books of PVA and NPVA, PVA students were turned out to be using more time in doing, which supports previous studies. However, PVA students do more exercise than NPVA, which is oppose to a previous study¹⁾. The way of using time per day may affected by the length of commuting time, which may vary with each year, so we should investigate further in the future.

3) Relations between visual acuity and a sleep

The relevance to visual acuity and sleep was clarified to be significantly shorter in NPVA in terms of nocturnal awakening, and also the average of a sleep and a deep sleep duration were longer in NPVA. No significant difference was observed due to the small parameter.

There were small number of NPVA students in 4th grade, which suggest the spreading of PVA among lower aged. Therefore, it is needed to measure in 2nd to 3rd grade student.

Consideration for prevention of decrease in visual acuity was performed significantly in PVA students, compared to NPVA. This is thought to be advised by parents. In addition, consideration for prevention against a group with NPVA is also important. Therefore, it was confirmed that both groups should be instructed to give consideration to preventing visual acuity reduction.

This study gave us a task, a lack of criteria for assessing the sleeping quality of students. The literature on children's sleep is physiologically measured. ²⁾ Therefore, sleeping condition does not guarantee the activity on daily lives of children.

Some students answered that they were satisfied with their sleep subjectively, even if they had a short sleep. Moreover, declining an activity and daytime sleepiness was not observed. In school lives, it is necessary to think whether it is a good sleep or not based on the satisfaction with actual living activities.

From now on, the further work is needed to examine child's sleep conscientiously, including enriching health guidance for sight maintenance.

References

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