Impact of Near Work Activity on Visual Acuity among Junior High School Students

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Abstract

Background: Uncorrected refractive error is experienced by at least 45 million productive-aged adults (aged 16–45 years old) and 13 million children (aged 5–15 years old), and being the main cause of visual impairment in children worldwide and third cause of blindness in any age in Indonesia. Near work activity is estimated as one of environmental risk factor causing this refractive error, leading into decreased visual acuity. This study was conducted to analyse the impact of near work activity on visual acuity among junior high school students in Jatinangor
Methods: This study was conducted in junior high school in Jatinangor, using cross sectional method. Total of 147 subjects were screened for visual impairment using Rapid Assessment of Avoidable Blindness (RAAB) tumbling E chart and assesed for near work activity using questionnaire-guided interview method after informed consent had been obtained. Data were analysed using unpaired-T test and Mann-Whitney test.
Results: Total diopter hours of near work activity among the group with visual acuity ≥6/18 and group with visual acuity <6/18 showed no significant difference (p=0.329), with latter group had less time-spent in near work activity. Similarly, each activity such as reading, watching TV, and using computer also showed no significant difference , except for playing games where the group with better visual acuity had shown significantly longer time spent than another group (p=0.018).
Conclusions: Near work activity does not have impact on visual acuity among junior high school students, except for playing games. **[AMJ.2016;3(1):38–42]**

Keywords: Junior high school students, near work activity, visual acuity

Introduction

World Health Organization (WHO) estimates that 314 million people around the world are having vision imparment. One hundred and fifty three million of them are caused by uncorrected refractive error that happened in various ethnic, with at least 45 million productive-aged adults (aged 16–45 years old) and 13 million children (aged 5–15 years old) are affected. Uncorrected refractive error is the main cause of visual impairment in children aged 5–15 worldwide, with significant increased on its prevalence, mostly among South-East Asia children. In Indonesia , this condition becomes the third cause of blindness. [1-3]

In order to decrease the rate of visual impairment such as refractive error, possible risk factor should be known. Thus the effective intervention could be implemented. According to Environment Health Model proposed by Blumm, the risk factor could be either genetic, environment, behavior, or health service. Although a proportion of myopia (nearsightedness) is clearly genetic, there is currently no conclusive evidence of genetic contributions to mild or moderate myopia.[4] Thus, beside many factors that interfere vision such as genetic, environment should be considered as the factor that could be intervened to prevent the occurence of visual impairment. Near work activity is assumed asone of the environtmental factors that causes the refractive error. Near work activity, which is the combination between such activities performed in near distance, is assumed to increase accomodation of lens as an adaptation to the near distance.[5]

A continuous contraction of cilliary muscle

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during accomodative process leads to an accomodation spasm, causing the lens diverge hardly into its initial curve, then its ability to see distant object decreased. Therefore, near work activity is often associated with myopia resulting in decreased visual acuity, since visual acuity would be impaired if there was any disturbance of visual such as refractive error.[4-9] Since there was lack of data about refractive error in Jatinangor, also in order to discover one of the probable risk factors of this refractive error which should be prevented as early as possible, this study was conducted to know the impact of near work activity on visual acuity in junior high school students in Jatinangor.

Methods

This study was an analytical study conducted in cross-sectional approach, carried out in Jatinangor district, from September–October 2013. All examination performed in this study was approved by Health Research Ethics Committee.

Samples of this study were chosen by multistage random sampling. From 11 junior high schools available, 3 junior high schools were chosen to represent the population. Samples were taken from each available class. One hundred and forty three males and females of junior high school students varying in aged 11–15 from 7th, 8th, and 9th grade who fit inclusion and exclusion criteria were used as subjects. Inclusion criteria was subjects who agreed to be involved in the study and aged below 15, and exclusion criteria was those who had organic visual disturbance or information of theirs could not be obtained completely.

Subjects were examined for visual acuity by a trained examiner at a distance of 6m using RAAB tumbling E chart, each eye separately started from right eye. Subjects who passed the test were classified into ≥6/18 visual acuity group, while subjects who did not pass were classified into<6/18 visual acuity group. Latter group then underwent a further examination using Snellen tumbling E chart and pinhole to differentiate refractive error from any other cause of visual impairment.

Both groups were interviewed to fulfill near work activity questionnaire, that was adopted from Sydney Myopia Study questionnaire. Subjects were asked about average amount of time spent (hours/day) in near work activity such as reading and doing homework, reading for pleasure, watching television, using computer, and playing electronic games both in weekday and weekend separately. For each activity, time spent in near work per day were calculated into total time spent each week (hours/week). Total diopter hours were counted as measurement of near work exposure based on accomodative weight required during each activity and its duration.[10] This diopter hours was defined as 3 x (hours spent studying + hours spent reading for pleasure) + 2 x (hours spent playing electronic games + using computer) + 1 x (hours spentwatching television).[11-14]

All data obtained from both examination of visual acuity and questionnaire interview were processed using Microsoft Excel programme and were statistically analyzed using unpaired T-test and Mann-Whitney non-parametric test. Statistically significant was considered when p≤0.05. Analysis was performed by comparing

Table 1 Characteristic of Subjects

Characteristic	Frequency (%)	Visual Acuity≥6/18	Visual Acuity<6/18	P value
Gender				
Male	56 (39.2%)	36 (64.3%)	20 (35.7%)	0.561
Female	87 (60.8%)	60 (69.0%)	27 (31.0%)	
Age				
11 years	1 (0.7%)	1	0	
12 years	22 (15.4%)	18	4	
13 years	44 (30.8%)	32	12	1.072
14 years	45 (31.5%)	27	18	
15 years	31 (21.7%)	18	13	
Total	143 (100%)	96 (67.1%)	47 (32.9%)	

Table 2 Hours Spent on Near Work Activity by Gender

Variables	Time spent (hours/week)			P value
	Total	Male	Female	
Reading	16.0 (2.5–47.5)	15.83 (2.5–47.5)	19.0 (2.5–37.5)	0.007
Watching TV	16.0 (0–39.0)	14.0 (0–39.0)	16.0 (0–36.0)	0.088
Using computer	7.0 (0–25.0)	7.0 (0–25.0)	7.0 (0–23.0)	0.967
Playing electronic games	7.0 (0–25.0)	9.0 (0–25.0)	7.0 (0–25.0)	0.195
Near work activity (diopter hours)	101.91±37.37	95.69 ± 38.84	105.92 ± 36.05	0.110

≥6/18 visual acuity group and <6/18 visual acuity group.

Results

Total of 147 subjects involved in this study joined thevisual acuity screening and questionnaire interviewing. Ninety six subjects had the visual acuity more than 6/18, and 51 subjects had the visual acuity less than 6/18. After latter group underwent further examination, 4 subjects were excluded because of organic causes, thus there were 47 subjects left in visual acuity less than 6/18 group.

From 143 subjects, there were more female subjects than males, mostly in age of 14 years old, and no significant difference in the visual acuity between male and female (p=0.561) (Table 1).

Mean of diopter hours in near work activity was 101.91±37.37 hours/week, with reading as an activity as the most time spent, both reading for study and reading for pleasure (16.0 hours/week), and playing electronic games as an activity with the least time spent (7.0 hours/week). In general, females spent a longer time in most near work activities, except playing electronic games. However, there was no significant difference between time spent in near work activity in males and females, except reading (including studying, doing homework, and reading for pleasure), where females significantly spent more time than males (p=0.007) (Table 2).

The group with visual acuity ≥6/18 showed longer time spent in near work activity than group with visual acuity <6/18. Nevertheless, there was no significant difference in diopter hours of near work activity between both group (p=0.329). The same result was shown for time spent in each near work activity, where the group with better visual acuity spent longer time in reading (16.45chours/week), watching TV (16.00 hours/week), using computer (7.25 hours/week), and playing electronic games (9.00 hours/week). Similar to the diopter hours result, each activity did not have significant differences in time spent between both groups, except time spent in playing electronic games that showed significant difference (p=0.018) (Table 3).

Discussions

This study aimed to determine the impact of near work activity on visual acuity. Based on the statistical result, time spent in near work activity did not have significant impact

Table 3 Hours Spent on Near Work Activity by Visual Acuity

Variables	Time spent (hours/week)		P value
	Visual acuity ≥6/18	Visual acuity <6/18	
Reading	16.45 (2.5–37.0)	15.50 (3.5–47.5)	0.689*
Watching TV	16.00 (0–39.0)	15.00 (0–30.0)	0.120*
Using computer	7.25 (0–25.0)	7.00 (0–24.0)	0.326*
Playing electronic games	9.00 (0–25.0)	6.50 (0–24.0)	0.018*
Near work activity (diopter hours)	104.05 ±35.88	92.00 (36.0–203.5)	0.329**

*Mann Whitney Test
**Unpaired–T Test

on refractive error, which in this study was measured by visual acuity, where group with visual acuity ≥6/18 and group with visual acuity <6/18 had similar mean in diopter hours of near work activity. This result was consistent with the study conducted by Lu et al.[15] and Ip et al.[4] in rural China and in Sydney respectively, where time and diopter hours on near work activities did not differ thechildren with and without myopia. Moreover, another cohort study conducted in Singapore[13] which is aprevious cross-sectional study concluded that children who read more were in a higher risk of developing myopia. This study alsohad proved that reading book did not associate with incident of myopia.

However, there were some similar studies that were contrary with this result, such as other study in Singapore[8] and India[9] that showed children who spent more time on near work activity such as reading, using computer and watching television were more likely to be affected by refractive error. This difference could be resulted from any other behavior and environtment factor that were not assesed in this study, such as continuity in doing such activities, lighting, type of object seen, and any other factors, and also genetic factor. Also, there were different range of age between the subjects in this study (11–15 years old) and in the previous study in Singapore8 (7–9 years old). Meanwhile, association between reading and myopia was predicted to be stronger in younger subjects, who were still in visual development period, than in the older one. This might explain why there were no significant difference in the time-spent on near work activity between both groups. It is because the subjects in this study were in a narrow age group and already at the age where eye was no longer developing. Thus this study did not show any significant impact. Hence, further study involving younger subjects might be needed in order to find the true impact of near work activity on refractive error development.

This study also showed that time spent in playing electronic games gave a significant effect on visual acuity, where group with better visual acuity turned out having longer time spent than another group. This result was quite opposite with any other previous study that had shown no impact of time spent in playing games on refractive error[16], but had similarity with Lu et al.[15] study where time spent on video games was significantly less in myopic children. Moreover, study conducted by Ip et al.[4] showed that playing hand-held console games was associated with more hyperopic (farsightedness) refraction, although it was unlikely to have a protective influence on the development of myopia. In this study, some subjects were playing games on their gadget, such as handphone, frequently but only in short period of time. It may explain why group with better visual acuity had longer time spent on playing games without having visual impairment. This condition can happen because they did not do the activities mentioned above continuously, while continuity on near work activity suggested to be a significant factor for myopia.[6] Hence, further study considering continuity of near work activity might be needed.

There were some limitations in this study that may had influenced those results. Cross sectional study design was chosen rather than cohort due to limited time in conducting this study, so it could not really measure the impact of exposure, in this case is near work activity, on expected outcome in particular period of time. Also, there could be inaccuracy in measurment of near work activity, since it assesed by interview, not direct observation, that could arise recall bias, and imprecision in subjects grouping due to limitation of tool used in measuring visual acuity.

In conclusion, this study showed that longer time spent in near work activity does not result in lower visual acuity. Therefore, it could not prove any impact of near work activity on visual acuity among junior high school students, even though there is no exact mechanism already known indeed.

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