Clinical Study on the Influence of Eye Care Habits on Myopia in School-age Children

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Abstract: In order to explore the relationship between the habit of using eyes and myopia, summarize and put forward to develop good habit of using eyes of school-age children to achieve the purpose of preventing myopia. 960 school-age children aged 7 to 12 were selected from the ophthalmology clinic of Fujian Provincial Government Hospital. The data collected included reading distance, sleep time, average daily outdoor activity time, average daily continuous eye use time. Ophthalmologists are responsible for visual examination, which includes mild myopia, moderate myopia and severe myopia. SPSS 22.0 statistical software was used for data processing. As a results,$P < 0.05$ was statistically significant. There are significant differences in the distribution of sleep time among the three groups ($P < 0.05$); There are significant differences in the time distribution of each continuous close eye use among the three groups ($P < 0.05$); There are significant differences in the distribution of distance habit among the three groups ($P < 0.05$); There are significant differences in the distribution of outdoor activity time among the three groups ($P < 0.05$).Myopia is closely related to the time of close eye use, the distance of eye use, the length of sleep and the length of outdoor activities.

1. Introduction

Children's eye hygiene has become a public health problem of public concern, especially the attention of education and health departments. Unscientific eye hygiene behavior will lead to children's vision damage, affect children's independent living ability, quality of life and mental health. Clinical evidence shows that myopia is the most common eye disease in school-age children, and it is one of the main causes of blindness and visual impairment. Prevention of myopia is the core of protecting students' vision, which should be paid enough attention to. In recent years, the prevalence of myopia in children is increasing and the age of onset is ahead of time. For the pathogenesis of myopia, up to now, almost all the internationally recognized mechanisms are mainly due to the lack of regulatory function, peripheral retinal hyperopia defocus and form deprivation. Insufficient accommodation, retinal defocusing or form deprivation lead to unclear retinal imaging and compensatory axial growth, which is an important mechanism of the occurrence and development of myopia. What is outside the eye should form a clear image on the retina, which requires that the refractive system of the eye coordinate with the anterior and posterior axis of the eye[1]. For the pathogenesis of myopia, up to now, the occurrence of myopia is affected by many factors, such as heredity and environment. The specific pathogenesis is not very clear. Generally, there are two reasons for myopia: one is congenital genetic factors, the other is acquired bad eye habits.

At present, there are two common methods of myopia treatment: corrective glasses and refractive surgery. However, from the actual clinical work of myopia correction, we can find that the prevention of myopia is greater than the treatment. Clinical practice shows that effective prevention and treatment of juvenile myopia can minimize the incidence of myopia. Therefore, in the clinical work of myopia correction, we need to implement effective prevention and control measures to help patients control and then achieve the effect of control and prevention of myopia. The parallel light from the infinite object refracted by the refractive system of the eye, the focus is just on the retina, so it can see the distance. The eye has the ability to automatically adjust the refractive power of the eye, so that the light from the near can focus on the retina, so that the near objects with different distances can be seen clearly. This effect is called eye regulation. Myopic children, reading and writing distance is often close, due to close use of eye adjustment to strengthen, will lead to ciliary muscle spasm fatigue, induce myopia. In order to prevent myopia, it is necessary to avoid excessive tension of eye muscles, which leads to the decline of its regulatory function. How to avoid excessive eye use needs to do the following aspects, such as: in the appropriate environment, enough light brightness, improve the close eye posture, shorten the close eye time, increase outdoor activities, reduce blue light radiation, which can

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effectively prevent myopia. In this study, computer optometry and questionnaire were used to comprehensively analyze the epidemiological status of myopia in school-age children and the knowledge of eye hygiene of myopia students, so as to provide the basis for the relevant departments to formulate scientific and reasonable myopia prevention strategies and measures[2].

2. Objects and methods

2.1 Objects

The purpose of this study is to understand the main eye use habits of school-age children, to explore the relationship between eye use habits and myopia, and to summarize and put forward to develop good eye use habits of school-age children, so as to achieve the purpose of preventing myopia. The subjects were school-age children from 7 to 12 years old in the ophthalmology clinic of Fujian Provincial Government Hospital. All the children who met the requirements were entered according to the inclusion and exclusion criteria. A total of 960 school-age children participated in this study. The inclusion criteria are as follows: living in the region for more than 6 months, no recent move out or long-term out plan[3]; Volunteer to participate in the questionnaire survey; Basic language understanding and communication skills. Exclusion criteria: those who could not participate in the survey due to illness, absence from school and other reasons; Refusal to sign informed consent. All the subjects in this study had informed consent. A number of graduate students are responsible for on-site maintenance, informed consent signature questionnaire survey and data collection.

2.2 Methods

Questionnaire investigation. Using the self-made "students' common diseases and health risk factors monitoring form" to conduct a questionnaire survey, to understand the general demographic characteristics and eye use habits of students. Before the survey, the investigators were trained to unify the survey standard and guide language. The questionnaire was completed within the specified time and collected on the spot. Before the formal investigation, the staff shall be trained to clarify the significance, purpose, method and detailed steps of the investigation, so as to ensure that each staff member is familiar with the filling in of various forms, various inspection instruments and various inspection procedures[4]. At the same time, referring to the literature, the meaning and content of each variable in the questionnaire are unified, the relevant definitions and standards are formulated, and the pre-test is carried out. The examiners recorded all the children, and used the self-designed "myopia susceptible population questionnaire" to investigate and examine the subjects. The data collected included: name, gender, date of birth, home address, contact information, name of parents or guardians, whether parents have myopia, reading distance, sleep time, interval of physical examination, eating habits, average daily outdoor activity time, average daily continuous eye use time.

Vision test. According to GB / T26343-2010 technical specification for health examination of students, the naked eye vision of the subjects was examined by professional doctors, and the national standard GB 1533-2011 standard logarithmic visual acuity chart was used. Make sure that the environment light is suitable, the light box of the vision chart is fixed on the wall, and the children are 5 meters away from the vision chart. Ask the child to cover one eye with a blindfold, and remind the child not to press the eyeball, so as not to affect the results of vision examination. The examinees were asked to identify the direction of the "e" gap within 3 seconds from top to bottom, and record the visual acuity value next to the last line of visual acuity. The diagnostic criteria for poor vision were: binocular uncorrected distant vision are greater than 5.0 was normal vision, and less than 4.9 was poor vision. Among them, 4.9 was mild; from 4.6 to 4.8 is moderate; 4.5 or below is severe[5]. Eye examination included uncorrected visual acuity, corrected visual acuity, intraocular pressure, small pupil optometry, mydriasis optometry. The investigators are a technical team composed of ophthalmologists, optometrists and ophthalmology graduate students working in our hospital to guide and supervise the research. Ophthalmologists are responsible for the evaluation, diagnosis and treatment of the patients. The collected data were first standardized and quantified, and the relationship between diopter and parents' myopia, reading distance, sleep time, interval of physical examination, eating habits, average daily outdoor activity time, average daily continuous eye use time were statistically analyzed[6].

Statistical analysis. The verified data were double entered by EpiData software and analyzed by SPSS 22.0. The measurement data were collected by $x \pm s$. The t test or ANOVA was used to compare the mean; The rate of counting data was described and compared χ 2 inspection. The non-conditional logistic regression model was used to analyze the influencing factors of students' bad eyesight. Inspection level $\alpha = 0.05$.

3. Results

3.1 Myopia and sleep time

The distribution of sleep time in three groups of myopia children was analyzed by Chi-square test[7], indicating that $P = 0.002$ ($P < 0.05$), and there were significant differences and statistical differences between the three groups.

Table 1. Relationship between myopia and sleep time

Group	Sleep time< 8 h (person)	Sleep time< 8 h (percentage)	Sleep time⩾ 8 h (person)	Sleep time⩾ 8 h (percentage)	Total
Low myopia	410	59.0%	285	41.0%	695
Moderate myopia	108	61.4%	68	38.6%	176
Severe myopia	66	74.2%	23	25.8%	89
Total	581	60.5%	379	39.5%	960

P=0.002(P<0.05)

3.2 Myopia and eye distance

The distribution of eye distance in three groups of myopia children was analyzed by Chi-square test, indicating that P = 0.002 (P < 0.05), and there were significant differences and statistical differences between the three groups.

Table 2. Relationship between myopia and eye distance

Group	Eye distance< 33 cm (person)	Eye distance< 33 cm (percentage)	Eye distance⩾ 33 cm (person)	Eye distance⩾ 33 cm (percentage)	Total
Low myopia	464	66.8%	231	33.2%	695
Moderate myopia	105	59.7%	71	40.3%	176
Severe myopia	12	13.5%	77	86.5%	89
Total	581	60.5%	379	39.5%	960

3.3 Myopia and duration of close eye use

The distribution of duration of eye use in three groups of myopia children was analyzed by Chi-square test[8], indicating that P = 0.005 (P < 0.05), and there were significant differences and statistical differences between the three groups.

Table 3. Relationship between myopia and duration of close eye use

Group	Duration of close eye use< 30 min (person)	Duration of close eye use< 30 min (percentage)	30 min ⩽ duration of close eye use < 60 min (person)	30 min ⩽ duration of close eye use < 60 min (percentage)	Duration of close eye use⩾ 60 min (person)	Duration of close eye use⩾ 60 min (percentage)	Total
Low myopia	186	26.8%	223	32.1%	286	41.2%	695
Moderate myopia	55	31.3%	40	22.7%	81	46.0%	176
Severe myopia	19	21.3%	10	11.2%	60	67.4%	89
Total	260	27.1%	273	28.4%	427	44.5%	960

P=0.005 (P<0.05)

3.4 Myopia and outdoor time

The distribution of outdoor time in three groups of myopia children was analyzed by Chi-square test, indicating that P = 0.001 (P < 0.05), and there were significant differences and statistical differences between the three groups.

Table 4. Relationship between myopia and outdoor time

Group	Outdoor time< 2 h (person)	Outdoor time< 2 h (percentage)	2 h ⩽ outdoor time < 3 h (person)	2 h ⩽ outdoor time < 3 h (percentage)	Outdoor time⩾ 3 h (person)	Outdoor time⩾ 3 h (percentage)	Total
Low myopia	324	46.6%	205	29.5%	166	23.9%	695
Moderate myopia	104	59.1%	50	28.4%	22	12.5%	176
Severe myopia	61	68.5%	22	24.7%	6	6.7%	89
Total	489	50.9%	277	28.9%	194	20.2%	960

P=0.001 (P<0.05)

4. Discussion

4.1 Effect of sleep time on myopia

Sleep is a physiological process that our body needs. Resting in line with the physiological needs is the necessary condition for our body to grow up according to normal standards. Sleep can be divided into REM sleep period and non REM sleep period[9]. Eye movement was observed by eye movement map during REM sleep. It was found that during sleep, eyes would move in the same direction at the same time, and then stimulate the movement of the muscles around the eyeball. Therefore, if the sleep quality is poor and the sleep period has changed, it will affect the movement of the periocular muscles by affecting the oculomotor nucleus, which will cause other structural changes of the eyeball and promote the process of myopia[10]. Some studies have shown that our plant nerves are also related to sleep. If the sleep quality is not good, the local sympathetic and parasympathetic functions of the eyes may be affected and the function of the ciliary muscles needs to be regulated by the plant nerve, so it will cause functional disorder and lead to myopia. The study thinks that poor sleep quality also has a certain risk to myopia, mainly because sleep deficiency is easy to cause the occurrence of visual fatigue, and visual fatigue is one of the main reasons for myopia. The results of this study confirm this conclusion.

Generally speaking, for children and adolescents, 8 hours should be a suitable sleep time, so we take 8 hours as a dividing point[11]. We compared myopic children who sleep less than 8 hours with those who sleep longer than 8 hours. The proportion of children with moderate myopia and severe myopia is higher than that of children with more than 8 hours. In other words, for children with myopia, the less sleep, the more likely they are to develop moderate and severe myopia. Through this study, we have reason to think that people who are not short-sighted are more likely to develop myopia if they have poor sleep quality than those who sleep well[12]. Therefore, we suggest that in order to protect children's eyesight, we should reasonably arrange children's homework, reduce the burden and pressure, improve their sleep quality, and prevent the adverse consequences of vision decline.

4.2 Effect of eye distance on myopia

In order to make the light clear on the retina and force the ciliary muscle to contract and the corresponding suspensory ligament to relax, the lens convexity will also increase, and the eye muscles can not be relaxed for a long time, leading to ciliary muscle spasm. In the long run, it will lead to myopia. Children and adolescents have poor self-control ability[13]. Without the supervision of teachers and parents, they may have improper sitting posture and even use some strange and distorted posture to read and assemble building blocks. These posture are difficult to control the distance of eyes. In the case of near vision, there will be muscle fatigue and tension around the eyes, resulting in poor accommodation, resulting in a series of myopic changes with longer axial length than normal eyes. And in the long-distance use of the eye, that is, when the eyes can be relaxed.

At present, the close distance generally refers to the visual distance within 33cm. In this study, the reading distance < 33cm is defined as the close distance eye, and the reading distance more than 33cm is defined as the long distance eye. This study showed that the nearer the reading distance of myopic children was, the more

myopic the number of myopic children was. There was a statistically significant difference in the distribution of close eye use habits between the two groups ($P < 0.05$). Close study and work have a certain impact on the formation of myopia. The difference of reading distance, watching video time, extracurricular activities time, parents' eyesight, obesity, diet and sleep between the low vision group and the normal strength group was statistically significant[14]. We have carried on the statistical analysis to this influence factor, the result is as follows. The degree of myopia was positively correlated with the distance of watching TV, the posture of reading and writing, the behavior between classes, the quality of eye exercises and the time of homework ($P < 0.05$). Writing, reading and computer reading are risk factors for myopia progression. Our research conclusion is basically consistent with that of other scholars. For mild myopia, the school-age children whose eye distance is less than 33 cm are twice as much as those whose eye distance is greater than or equal to 33 cm; For severe myopia, the school-age children whose eye distance is greater than or equal to 33 cm are 6.4 times as much as those whose eye distance is less than 33 cm.

4.3 Effect of duration of close eye use on myopia

Close eye use means that the visual distance is within 40cm-50cm. However, in this information age of rapid development, the demand for close eye use increases with the development of network, and the time of close eye use becomes relatively more. For example, looking at mobile phones, computers, hand knitting and so on all belong to close eye. If you look close for a long time, it is easy to cause spasm of ciliary muscle and extraocular muscle, When the accommodation ability of the eye decreases, a series of morphological and structural changes such as lens convex, bending force increasing and axial growth will appear, resulting in myopia[15]. Through the investigation of the relationship between short-range eye use and myopia of urban and rural children in Xiamen, it is found that compared with rural children, urban children have longer continuous reading and writing time and less rest time. The result is that the myopia rate of urban children is higher than that of rural children. It also proves that the continuous short-range eye use time is closely related to the occurrence of myopia. In a multivariate logistic regression analysis of myopia, it was found that the more likely the myopia was, the longer the homework lasted for more than 30 minutes without rest. After reading books or electronic products for 40 minutes, the eyes can rest, and there are some ways to look at the distance or green plants. The proportion of low vision group is significantly lower than that of normal vision group. Therefore, 30-40 minutes per eye use is a reasonable time for close eye use, and this conclusion is theoretically applicable to people of all ages, and also provides ideas for schools and office units to formulate learning and work plans.

Therefore, in order to confirm the effect of continuous close eye use time on myopia, the children's daily close eye use time was asked in the designed questionnaire. Through our statistical analysis, we found that the longer the near-sightedness time, and the children who do not rest in the middle of the way, the more likely they are to have myopia degree more than 600 degrees. Among the children of the same age, 186 children with myopia of 50 to 300 degrees, 55 children with myopia of 300 to 600 degrees, and only 19 children with myopia of more than 600 degrees were seen for less than 30 minutes each time[16]. However, with the extension of continuous eye use time, the number of people with mild, moderate and high myopia who used eyes for 30 minutes to 1 hour was 223, 40 and 10 respectively. The number of people who have been using their eyes for more than 60 minutes will soar to 286, 81 and 50. The number of people with high myopia is 3.2 times of those with less than 30 minutes of eye use.

4.4 Effect of duration of outdoor time on myopia

In the process of outdoor activities under natural light, the eyes can see far away. The eyes can not only see infinity, but also see distant green plants. The eyes are in a comfortable environment, the lens can be adjusted, the ciliary muscles can be fully relaxed, and the retina can grow and repair after being stimulated by natural light, Therefore, increasing the time of outdoor activities can not only improve the visual acuity, but also slow down the occurrence and development of myopia. Through a comparative study on whether the outdoor activity time of Chinese students in Singapore and Sydney is related to the occurrence of myopia, the study shows that Chinese students in Singapore do not have enough outdoor activity time due to heavy learning burden, while Chinese students in Sydney do the opposite. Therefore, the prevalence of myopia in the former is higher than that in the latter. It is thus known that the increase in outdoor activity time is helpful to reduce the incidence rate of myopia in students. The investigation of students' eyesight and its influencing factors shows that the risk of poor eyesight is significantly reduced in the students who take breaks, especially outdoor activities outside the classroom. Students can participate in sports activities after class is the protective factor of poor eyesight. Increasing outdoor activity time can reduce the incidence rate of myopia to varying degrees. The results show that the risk of poor eyesight of students who take part in extracurricular activities outside the classroom is significantly lower than that of students who take part in extracurricular activities or reading in the classroom. Therefore, the increase of outdoor activities can produce a certain degree of protection to prevent the occurrence and development of myopia.

In this study, outdoor activity time is divided into three time nodes, which are less than 2 hours, hours between 2 and three, and more than 3 hours. The research shows that whether it is mild myopia, moderate myopia or high myopia, the shorter the outdoor activity time of myopic children, the more the number of them. The difference of different outdoor activity time between two groups of myopic children is statistically significant

($P < 0.05$). Only 6 school-age children with high myopia spend more than or equal to 3 hours outdoor activities, accounting for only 6.7% of school-age children with high myopia. With the increase of outdoor activities, the number of myopic children decreased. In the relevant papers and materials published by some domestic researchers, children and teenagers' increasing outdoor sports is equivalent to increasing the distant vision time. Relatively speaking, it directly reduces the near vision time, and the eyes can get a longer rest, which indirectly relaxes the ciliary muscles of the eyes, thus slowing down the occurrence and development of myopia.

5. Conclusions

This paper selects 960 children aged 7 to 12 years old from Fujian Provincial Government Hospital. Through questionnaire, visual acuity test and statistical analysis, the main eye habits of school-age children are studied, and the relationship between using habits and myopia is discussed. The results showed that sleep time, eye distance, continuous close eye use time and outdoor activity time were closely related to children myopia.

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