



Correlation between equivalent spherical diopter and visual acuity, stereo vision of schoolchildren

Fen-Chi Lin¹, Shuan-Yu Huang^{2*}

¹ Department of Ophthalmology, Kaohsiung Armed Forces General Hospital, Kaohsiung 802, Taiwan, ROC.

² Department of Optometry, Chung Shan Medical University, Taichung 402, Taiwan

syhuang@csmu.edu.tw

Abstract: The correlation between equivalent spherical diopter and visual acuity, stereo vision of schoolchildren in Taichung were investigated. This study investigated the refractive diopter, visual performance, and visual perception ability of children in elementary school, and analyze whether the performance of the above parameters is different in different genders. By understanding the above-mentioned visual performance and refractive diopter of children, it can be analyzing and predicting the possibility of developing myopia, and a good effect on the prevention and treatment of myopia in the future.

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Keywords: visual acuity, diopter, visual function

1. Introduction

In Taiwan, the myopia rate rised rapidly. How to prevent myopia became an important issue that parents always worried about. Many studies have pointed out that prolonged use of eyes at near distance is one of the reasons for the rapid development of myopia during the growth of children, especially in younger children [1-3].

One study investigated the myopia development of schoolchildren in Tapei city, the reading distance playing an important role on the development of myopia in the early stage. The development of myopia is relatively rapid [4]; in addition, the time spent of outdoors activities is also considered to be a key to preventing myopia. SAVES is a study on the myopia risk factors of Australian school children. School children with myopia have significantly less time for outdoors activities [3], and a study published by Dr. Wu also pointed out that the time spent for outdoors activities and exposed sunlight are the key factors for myopia control and prevention [3].

However, in addition to paying attention to children's near-sightedness and increasing outdoor activity time can effectively help prevent and control the occurrence of myopia, regular tracking of the eye's refractive diopter, vision, and visual perception can help accurately understand the health of the eyes. Regular eye examinations are the most fundamental and extremely important in the process of myopia prevention and treatment [5-7].

The purpose of this study is to check the refractive diopter, visual performance, and visual

perception ability of children in elementary school. By understanding the above-mentioned visual performance and refractive diopter of children, it can be analyzing and predicting the possibility of developing myopia, and a good effect on the prevention and treatment of myopia in the future.

2. Materials and Methods

(1) Measurement of visual acuity

The standard 6 m Snellen visual acuity chart was used to measure the visual acuity of the subjects. Since most subjects were not wearing corrective prescriptions, except for some subjects with refractive errors, the naked vision and post-correction were measured. Most subjects only measure naked visual acuity.

(2) Measurement of the subjects' diopter

The spherical diopter and astigmatism of each subject were measured by a computerized refractor.

(3) Observation of the subjects' stereo vision

In the state of the subject's vision correction at a short distance (40 cm), the Stereopsis Butterfly Randot book and polarized glasses were used to test the subject's best stereo vision.

(4) Statistical methods

This study uses each eye as a single data, using Microsoft Excel 2016 to collate and use IBM SPSS Statistics 24.0 for data analysis. The independent sample T test was used to analyze whether the tested data has reached a significant difference between the male and female groups. The correlation between diopter and visual acuity is analyzed by Pearson's

correlation coefficient. In this study, the visual acuity value is analyzed in logarithmic form (Log MAR), the diopter is expressed in the form of Spherical Equivalent Power (SE), and the degree of astigmatism is converted into an angle of 0 degrees (J0) and 45 degrees (J45) for analysis.

3. Results and Discussion

Figure 1 shows the correlation between the equivalent spherical diopter and the visual acuity of the right eye. Most of the subjects are still emmetropia, and the visual acuity performance is also within the expected value. Due to the measurement of visual acuity in this study is undertaken in naked eye, that is, the uncorrected state, so it can be seen that the diopter

has a direct impact on the visual acuity. When the refractive state of the subjects are not corrected, the visual acuity performance of the school children is not good, and the value VAsc (LogMAR) is more than zero. There is a statistically significant and moderate negative correlation between the equivalent spherical diopter and the visual acuity. The experiment results also remind us to correct the refractive error completely even the myopia is just beginning to develop, so that it will not lead to poor quality of vision in daily life. Figure 2 shows the correlation between the equivalent spherical diopter and the visual acuity of the left eye. The results of Fig.2. is consistent with the result of Fig.1.

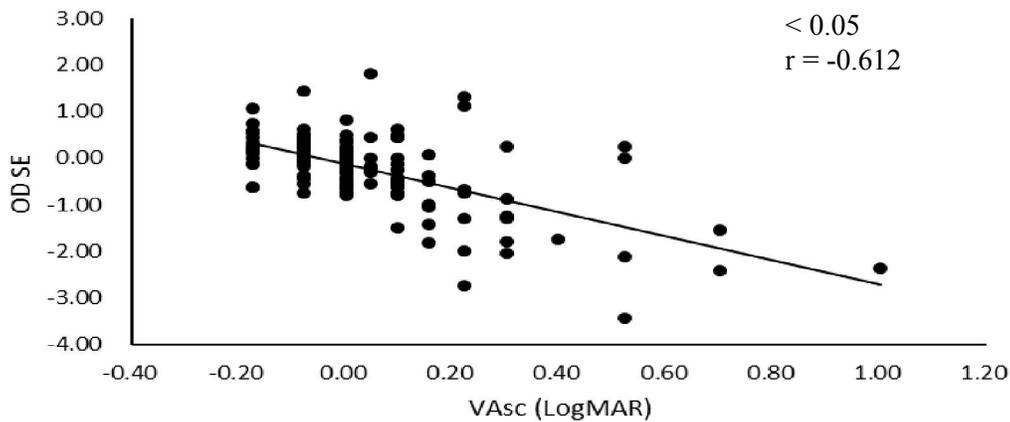


Fig. 1. The correlation between the equivalent spherical diopter and the visual acuity of the right eye.

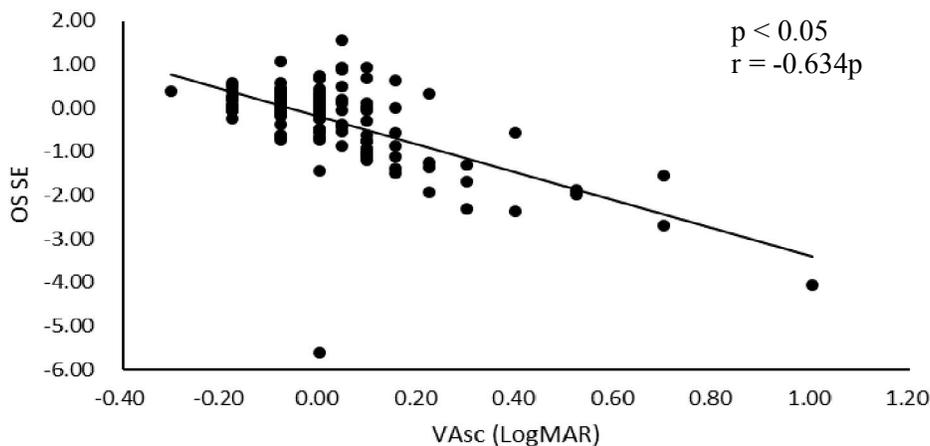


Fig. 2. The correlation between the equivalent spherical diopter and the visual acuity of the left eye.

Stereo vision is a part of depth perception in our visual development. It is a common way to clinically assess to evaluate the binocular vision. The difference in refractive diopter and the correction of the refractive state are also the factors that lead to the development of stereo vision. Figure 3 shows the distribution of stereo vision of the different genders. The expected value of stereo vision at this age is less than 100 seconds of arc. It can be seen that most

subjects can meet the expected value of stereo vision. Only one of the two groups of male and female students did not meet the expected value. In addition, the Female schoolchildren in the lower levels have better performance in stereo vision, which also indicated that the difference in gender and diopter may have a certain impact on the development of visual perception.

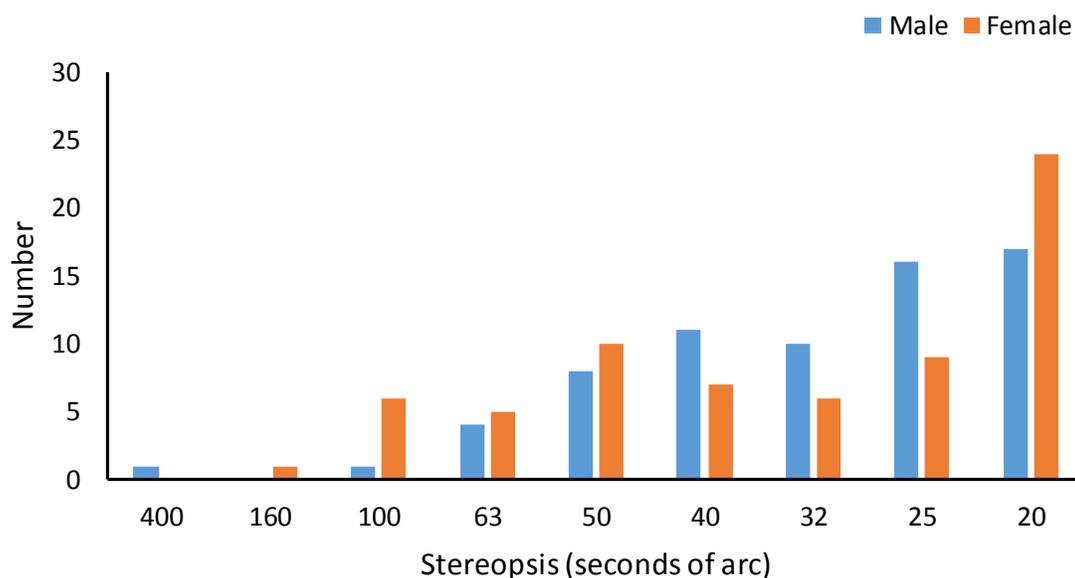


Fig. 3. The distribution of stereo vision of the different genders.

4. Conclusions

This study investigates the correlation between the equivalent spherical diopter and the visual acuity of the right eye. The results represent a statistically significant and moderate negative correlation between the equivalent spherical diopter and the visual acuity. The distribution of stereo vision of the different genders is also discussed. Most subjects can meet the expected value of stereo vision. The Female schoolchildren in the lower levels have better performance in stereo vision, which also indicated that the difference in gender and diopter may have a certain impact on the development of visual perception.

Corresponding author

Shuan-Yu Huang,
Department of Optometry, Chung Shan Medical University, Taichung 402, Taiwan, ROC.
E-mail: syhuang@csmu.edu.tw

References

1. Holden, B.A., et al., *Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050*. *Ophthalmology*, 2016. 123(5): p. 1036-42.
2. Grzybowski, A., et al., *A review on the epidemiology of myopia in school children worldwide*. *BMC Ophthalmol*, 2020. 20(1): p. 27.
3. French, A.N., et al., *Risk factors for incident myopia in Australian schoolchildren: the Sydney adolescent vascular and eye study*. *Ophthalmology*, 2013. 120(10): p. 2100-2108.
4. Hsu, C.-C., et al., *Risk factors for myopia progression in second-grade primary school children in Taipei: a population-based cohort study*. *British Journal of Ophthalmology*, 2017. 101(12): p. 1611-1617.
5. Wu, P.-C., et al., *Myopia prevention and outdoor light intensity in a school-based cluster randomized trial*. *Ophthalmology*, 2018. 125(8):

- p. 1239-1250.
6. C. A. Chu; M. Rosenfield; J. K. Portello. (2010). Computer Vision Syndrome: Blink Rate and Dry Eye During Hard Copy or Computer Viewing. *Investigative ophthalmology & visual science*. 51(13): 957.
 7. C.G. Blehm; S. Vishnu; K. Dawson; A. Chuang; R. Yee. (2004). Ocular Surface Analysis and Treatment in Computer Vision Syndrome. *Investigative ophthalmology & visual science*. 45(13): 3912.

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