

Exploration of Correlation between Myopia and Eye Flexion Elements in Adolescents

Zhenghong Zhou, Sheng Mao, Hualing Yin, Lei Gong^{a,*}

Qujing Medical College, Qujing, Yunnan, 655000, China

^a gonglei.gl@qq.com

*corresponding author

Keywords: High Myopia, Progression, Diopter, Ocular Axis.

Abstract: Objective: to explore and analyze the development of high myopia in different age groups and the relationship between diopter and ocular axis. Methods :176 patients with high myopia (352 eyes) were divided into 4 groups :32 eyes (9.1%) in group 1,96 eyes (27.3%) in group 2,164 eyes (46.6%) in group 3,60 eyes (17.0%) over 50 years of age and 1 diopter. The axial length and composition length of diopter matrix in four groups were measured. Results: The myopia diopter of the two groups was deep (-5.94 ± 1.63) d ($t = -3.651$, $P = 0.001$), and the length of the ocular axis was prolonged (3.25 ± 0.70) (t =4.662, PP=0.001). diopter of high myopia of all ages is mainly related to the ocular axis ($r = 0.649$), and the ratio of the two is relatively stable. Generally, myopia increases by 1.73 d. for every 1 mm extension Conclusion: High myopia develops rapidly before the age of 20 and tends to stabilize after the age of 20. The diopter of high myopia is mainly related to the axis of the eye.

1. Introduction

Kaiser first named ametropia for both eyes in 1867. With the progress of scientific research, the universality of anisometropia and its close relationship with binocular visual function, amblyopia and other diseases have attracted the attention of scholars, and carried out various studies on it. When anisometropia, because of the size and clarity of binocular images, it affects the function of binocular fusion and the establishment of stereoscopic vision, which can lead to visual dysfunction. binocular vision enhancement occurs when the anisometropia between the eyes is large, and when the anisometropia between the eyes is larger (≥ 3 D), the binocular inhibition will occur.

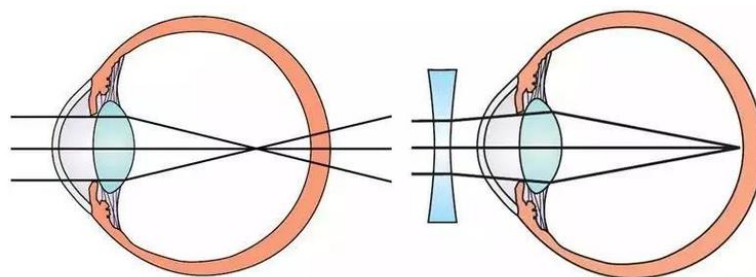


Figure 1 Amounts

The eyes use the matching adjustment and the collection, causes the eyes of both eyes to converge stably on the gaze point, the brain visual center carries on the analysis to the visual signal from both eyes, integrates into a complete, three-dimensional visual perception, thus forms the binocular vision. However, for the progressive development of anisometropia, it is possible to cause the increase of the size, shape and clarity of binocular visual imaging, resulting in the damage of binocular visual function in patients of different ages, resulting in visual fatigue and visual distress [1]. In the process of optometry matching, optometrists often give high-level digital glasses and low-fitting glasses in order to satisfy the comfort of wearing glasses for patients with anisometropia

and alleviate the visual distress of binocular optic lenses to form retina. Although this kind of treatment satisfies the comfort of anisometropia patients wearing glasses to a certain extent, it invisibly destroys the normal binocular balance of patients, makes the adjustment needs and stimuli of different eyes do not match, and the collective function between the eyes will be disturbed accordingly. So, how to intervene early, correct the ametropia of patients with anisometropia reasonably, improve the co-motion parameters of their binocular abnormalities as much as possible, including the regulation and collection function of single and double eyes, and their matching degree, and then promote the normal development and optimization of binocular vision, and slow down the increase of myopic anisometropia and myopic development is the direction and goal of our research.

Myopia is a common refractive disease in modern society. high myopia refers to myopia with ametropia greater than -6.00 D. the incidence rate is 0.95%, accounting for 18%-24% of myopia [1-3]. it is generally considered that corneal refraction, lens system and eye axis are the most important factors affecting myopic diopter. in recent years, it has been confirmed that abnormal increase of axis is the decisive factor of high myopia, but most previous studies have focused on genetic research and neglected the development of high myopia itself. The relationship between diopter and diopter in different age groups and ocular axis is less advanced, so this study aims to explore the development of high myopia in different age groups and the relationship between diopter and ocular axis in different stages.

2. Information and Methods

Data from february 2017 to february 2017,176 patients in our department of ophthalmology, including 96 males and 80 females, aged 3-67, mean age (20.52~17.19). spectroscopic and direct ophthalmoscopy excluded other organic ophthalmopathy, Dipter spherical ,6.00~20.00 d, were divided into 4 groups by age :32 eyes under 14(9.1%),96 eyes under 15 years (27.3%) and 164 eyes under 20 years (46.6%).

Visual acuity of test indicators: examination of naked eye and corrected visual acuity with standard logarithmic visual acuity; myopia diopter: dilation of pupils with local amide and use of topcon RM, with inserts before testing 80th century computer optics, ophthalmoscope parallel optometry, conversion of astigmatism diopter to corresponding spherical diopter, measurement of anterior chamber depth, lens thickness and ocular axis length.

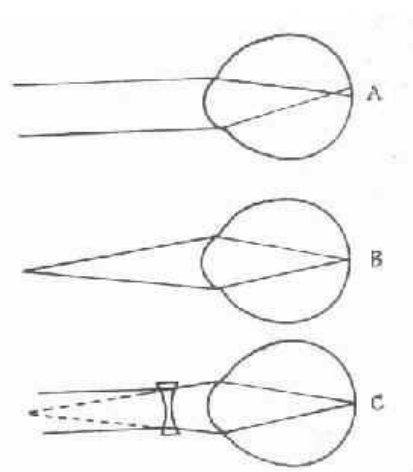


Figure 2 Amounts

The statistical processing was analyzed by SPSS 20.0 statistical software package, the measurement data were expressed as mean \pm standard deviation (), the t test was used, and the correlation was analyzed by multiple linear regression analysis. $P < 0.05$ was statistically significant.

3. Results

The diopter of high myopia, the progression of the ocular axis were compared by age group order .2 groups (15~20 years) had a higher diopter (-5.94 ± 1.63) D ($t = -3.651$, $P = 0.001$), and the ocular axis was prolonged (3.25 ± 0.70) mm ($t = 4.662$, $PP = 0$). There was no significant difference in diopter ~ ocular axis between the two groups (15 and 20 years) and three groups (31~50 years), three groups and four groups (>50 years). there was no significant difference in anterior chamber depth, crystal thickness, corneal refractive power between the four groups.

Table 1 Comparison of visual acuity, diopter, safety index and effective index of naked eye after operation () two groups

Group	Bare eye vision	Diopter (D)	Security index	Effective index
A group (n=106)	1.01 ± 0.24	0.15 ± 0.48	1.02 ± 0.13	0.97 ± 0.11
B group (n=106)	0.99 ± 0.33	0.14 ± 0.45	1.03 ± 0.12	0.98 ± 0.15
t	0.505	0.157	0.582	0.554
P	0.614	0.876	0.561	0.581

The diopter of high myopia in all ages was mainly related to the ocular axis ($r = 0.649$), the myopia of high myopia increased by about 1.73 mm, each extension of the ocular axis D; and the diopter developed at all ages was always closely related to the ocular axis ($r = 0.728 \pm 0.119$).

4. Discussion

For young and middle-aged patients, more eye use needs to be a long time heavy load of close work, so the height of the undercorrection of the eyes do not interfere with close distance more than long distance. Although the eyes receive the same amount of adjustment stimulation, the actual adjustment needs are different, that is, the height of the low orthosis mirror will pay less adjustment than the low degree eye of the full orthosis mirror, which can obtain clear myopia relatively easily. However, once the dominant eye is formed, it is not permanent, it will also be subjected to varying degrees of visual interference, which will affect the neural network of binocular vision. When the dominant eye gradually loses or weakens the input of clear visual signal and lasts enough time, the non-dominant eye may be transformed into the dominant eye.

According to the results of this paper, the myopia of high myopia at 15~20 years old is obviously deeper than that of those under 15 years old, and the ocular axis is also extended accordingly, while the diopter and the change of ocular axis in the latter 20 years are not obvious. This shows that high myopia is in a period of rapid progression before the age of 20, and the development of myopia after the age of 20 tends to stabilize, and the degree of myopia no longer continues to deepen. meanwhile, the results of this study also showed that the diopter of high myopia was mainly caused by excessive lengthening of the ocular axis, and the correlation between the two was high ($r = 0.649$), and the myopia increased by 1.73 mm, each extension of the ocular axis D, which was basically consistent with previous literature reports; moreover, this correlation of diopter and ocular axis showed consistency and stability at all ages.

Many studies have shown that the quality of regulatory function plays an important role in the development of myopia. regulation is the phenomenon that the eyeball changes refractive index according to visual needs. instead of focusing the target light on the retina, a diffusion point is formed, resulting in visual blurring of the eye. as a feedback from the brain, fuzzy vision can induce the corresponding pulse rate of the nerves that control the ciliary muscle, thus changing the lens shape, increasing reflection refraction, appropriately converging close to the target light, forming clear retinal images. physiological regulation of lens plasticity and muscle aggregation is necessary for regulatory function realization. adjustment response, positive and negative relative adjustment, adjustment flexibility, etc. Adjustment interval refers to the maximum adjustment ability that the eye can play, that is, the difference between the dynamic and static diopter of the human eye, which represents the maximum response of the eye to the target. Objective: Regulatory measures should

be equated with regulatory incentives.

As a definite hereditary ophthalmopathy, high myopia often occurs in infancy, and its progression time and amplitude are higher than that of low myopia. Moderate and low myopia often starts around 10 years old and generally reaches a stable state before the age of 20 without progression. This article shows that high myopia has been developing from infancy (the age of children is over 3 years old, but the true age of myopia is to be determined), and its diopter, ocular axis and vitreous cavity depth are growing and developing accordingly. This is of great significance to the clinical diagnosis and treatment :1 For children with high myopia, both parents or one of them, an eye examination is required every year after birth to detect, treat and follow up the incidence of high myopia in the next generation as soon as possible, which is of great value to the long-term eye health of children and the disease study of the whole social group; Patients with high myopia who wish to undergo corneal laser surgery or intraocular refractive surgery (including crystal intraocular lens implantation or transparent intraocular lens replacement, etc.) to correct their high myopia must be over 20 years of age, because their myopia is still in the process of progress before the age of 20, so premature surgery has adverse effects on the success rate of surgery, patient satisfaction and so on; Post-scleral fixation is the only procedure that can control the prolonged hyper-axial surgery and the continuous deterioration of high myopia. Although the operation is widely regarded in the eye community, the positive effects may be expected. The results suggest that the operation should be performed before the age of 20, i.e. before the high myopia is stable.

Acknowledgements

This research has been financed by The Science Research Project in 2020 of Yunnan Provincial Fund “Research of myopia for school-age children in Qujing area” (2020J0805)

References

- [1] Quan, Wensheng. Astigmatism axis anisometropia and eyeglasses matching. Chinese Journal of Glasses Technology, no. 09, pp. 52-53, 2006.
- [2] Cheng, CY.,Yen, MY., Lin, HY.,et al. Association of ocular dominance and anisometropic myopia. Invest Ophthalmol Vis Sci, vol. 45, no. 8, pp. 2856-2860, 2004.
- [3] Luo, Wuqiang., Liu, Weimin., Huang, Jianzhong., et al. Clinical observation of dominant eye transition before and after LASIK operation. Guangxi Medical Science, vol. 32, no. 12, pp. 1475-1477, 2010.