Original Article

Epidemiological Study of the Development of Visual Acuity in Preschoolers Aged 3 to 6 in the Shenzhen Area

Min Fu*, Juan Lu, Qixia Chen, Weiqiang Zhao

Department of Ophthalmology, Shenzhen Women and Children Hospital, Affiliated with Southern Medical University, Shenzhen 518048, China

Abstract

Purpose: To investigate the visual acuity of preschoolers aged 3 to 6 years in Shenzhen of China.

Methods: Visual acuity was measured in preschoolers from eight kindergartens in Shenzhen.

Results: A total of 1147 children completed the visual acuity test.There were 77 boys and 62 girls aged 3 years, 259 and 216 aged 4, 193 and 160 aged 5 and 94 and 86 aged 6. The mean visual acuities of children aged 3, 4, 5, and 6 years were 0.51±0.10, 0.54±0.13, 0.65±0.14, and 0.71±0.17, respectively. The visual acuity was significantly improved with increasing age (P=0.000).

Conclusion: For preschoolers aged 3 to 6, the visual acuity continuously develops and improves. Therefore, age should be considered when diagnosing amblyopia in children. (***Eye Science 2013; 28:60-61***)

Keywords: visual acuity; preschoolers; age

During the preschool period, the visual acuity in children continuously develops and matures. Consequently, age as well as visual acuity should be taken into account in the diagnosis of amblyopia. However, the developmental pattern of visual acuity in preschoolers has not been intensively examined in prospective studies and the underlying developmental mechanism remains elusive. The present study is a 3-year prospective study of the visual acuity development in preschoolers from Shenzhen, aimed at establishing its underlying pattern. The baseline results of visual acuity tests were reported.

DOI: 10.3969/j.issn.1000-4432.2013.02.002

* **Corresponding author**: Min Fu, E-mail: 642660719@qq.com

Subjects and methods

Study subjects

In total, 1156 preschoolers (627 boys and 529 girls) aged 3-6 years attending 8 kindergartens in Shenzhen were enrolled in this study. Prior to testing, informed consent was obtained from the parents of each participant. Ocular examinations included a visual acuity test, slit-lamp examination, strabismus examination, axial length measurement, objective retinoscopy with the ciliary muscles paralyzed, and manifest refraction. Before the visual acuity test, the participants were instructed regarding the usage of the visual acuity chart and an EDTRS chart was used. If the children correctly identified 4 targets, the examination proceeded to the next line. The examination was concluded when 3 targets were incorrectly identified.

Statistical analysis

SPSS 13.0 software was used for data analysis. $P<0.05$ was considered as statistically significant.

Results

Among the 1156 participants, 1147 (2294 eyes, 99.22%) underwent the examination, including 623 males and 524 females. The visual acuities significantly differed among children aged 3, 4, 5, and 6 years (0.51±0.10, 0.54±0.13, 0.65±0.14, and 0.71±0.17, respectively).

Discussion

The preschool period is vital to the development and maturity of visual acuity in children[1]. Therefore, conventional visual acuity tests and ocular examinations are of significance for the early identification

Table 1 General information

Groups	Number	Male	Female	Visual acuity
3–year–old	139	77	62	0.51±0.10
4–year–old	475	259	216	0.54±0.13
5–year–old	353	193	160	0.65±0.14
6–year–old	180	94	86	0.71±0.17
X^2				527.96
P				0.000

and diagnosis of strabismus and amblyopia in children aged 3–6 years. The incidence of ametropia in preschoolers is mainly correlated with heredity, congenital development, and environmental factors[2]. Consequently, preschoolers require regular visual acuity tests, delivery of ocular healthcare, and early treatment. The present study showed that the visual acuities of preschoolers significantly differed with increasing age, which is basically consistent with previous findings, and confirms that visual acuity continuously matures over time. However, the visual acuity in each respective age group significantly differed from values reported previously[3–5]; this was probably due to the increased difficulty of examination, the perception of children, and the number of cases, *etc.*

No consensus has yet been reached regarding the youngest age for performance of a visual acuity test, or for examination methods, determination of visual acuity abnormalities, or asthenopia diagnosis. Therefore, the incidence of amblyopia in preschoolers has not been accurately reported due to the lack of the diagnostic criteria for asthenopia. Previous studies reported that the incidence of amblyopia is approximately 1–5%. In the United States, this incidence in children aged 3 to 5 was 2.9–3.9%[6], 0.7% for 6-year-old children in Australia, 0.4% in South Korea, and 0.14% in children aged 6 to 12 in Japan. Recently, the incidence of amblyopia in Chinese children was reported at 5.89 – 11.80%. Considering that the development of visual acuity is a dynamic process, the factor of age should therefore be taken into account when measuring visual acuity in preschoolers. For preschoolers, low visual acuity does not signify abnormal visual acuity. In the present investigation, the visual acuity was poorer in children aged 3–6 in Shenzhen, especially those aged 5 or 6, when compared with children in previous studies. This difference is probably correlated with use of eyes, regional discrepancy, and economic and cultural development. We speculate that the poorer visual acuity in Shenzhen preschoolers might result from frequent contact with electronic devices, fewer outdoor activities, and excessive near-distance use of eyes in front of computers and TVs.

The current domestic diagnostic criterion is directly adopted in most investigations without considering the influence of age. To reduce the incidence of delayed and missed diagnosis of ametropia, we recommend comprehensive screening and diagnosis procedures for ametropia that also incorporate the influence of age. To perform early diagnosis and treatment of ametropia and to improve the quality of visual acuity in children, the characteristics and patterns of visual acuity development should be understood and proper measurement methods should be adopted for children of different ages.

References

1 Wang SM, Wang FR. Eye care for children, Beijing: Peking University Press, 1999: 63–78.

2 Zhan F, Li Z, Yang ZK, et al. Epidemiological study of the development of refraction and visual acuity in preschoolers aged 3 to 6 in the Guangzhou area. Chinese Journal of Optomrtry Ophthalmology and Visual Science, 2010, 12(2): 138–141.

3 Li HJ, Li XY. Analysis of vision acuity in preschoolers in Siming of Xiamen city. Chinese and Foreign Medical Research, 2011, 9(20): 61–62.

4 Zhu H, Zheng WZ, Huang PP, et al. Investigation analysis of vision acuity in preschoolers in Shanghai area. China's Maternity and Child Care, 2011, 17(2): 3.

5 Li HX, Zhang GS, Zhang BD. Investigation of vision acuity in children in the surrounding area of Hohhot city. Chinese Journal of Strabismus and Pediatric Ophthalmology, 2010, 18(2): 90.

6 Amoid RW. Amblyopia and strabismus prevalence. Ophthalmology, 2009, 116(2): 365–366.

7 Zhao KX. Pay a special attention to the influences of age on children amblyopia diagnosis. Chinese Journal of Ophthalmology, 2007, 43(11): 961–964.