

Should Astigmatism be Corrected until the Age of Three? Results of a Six-year Study of Refraction in Children

Simeonova A.S.¹, Chernodrinska V.S.²

¹(Medical University – Sofia, Bulgaria)

²(Pediatric Ophthalmology, Alexandrovska University Hospital, Sofia, Bulgaria)

Abstract: The state of refraction in young children is important to be examined in order to prevent different eye diseases (amblyopia, strabismus, hordeolosis, blepharitis etc.). Part of these diseases may interfere with the normal development of a child, as well as they may affect the process of socialization.

AIM: The aim of this study is to determine and follow-up aspheric refraction dynamics in children up to age three.

Patients and Methods: The study covers 324 children (648 eyes) from Sofia city and Sofia district (Bulgaria), aged between 6 and 12 months at their first visit and refraction examination. 159 of them are girls (318 eyes) and 165- boys (330 eyes). The children are followed up in time. They are grouped in four age groups and divided by gender.

The **methods** used are: photorefractometry with PlusoptiX S04; cycloplegia, retinoscopy and optical correction if needed; statistics.

Results: Astigmatism changes with age (towards reducing); Diopters of astigmatism are most decreased in age between 12 and 18 months; There is no statistically significant difference in aspheric refraction between genders.

Conclusion: PlusoptiX S04 photorefractometer is operational for children aged at least 5 months. This is a quite accurate method for determining the aspheric refraction in children without cycloplegia. It allows us to state that astigmatism reduces considerably with age.

Keywords: astigmatism; children; dynamics; refraction.

I. Introduction

There is enough literature data about the dynamic changes of the spherical refraction during childhood. The information about the dynamics of the aspheric refraction is much poorer.

According to the World Health Organization, uncorrected refractive errors are about 43% of the causes of reduced vision and affect 153 million people in the world. 19 million children under the age of 15 have low vision, while 12 million of them are with uncorrected ametropia. This fact determines the need of continuous and thorough examination of the refraction dynamics in children, as well as prompt and adequate optical correction of the refractive errors.

The purpose of this study is to determine and follow-up aspheric refraction dynamics in children up to age three and to find an answer of the following questions:

- 1} What is the frequency of astigmatism in early childhood?
- 2} Does astigmatism change with age?
- 3} Is there a difference in the refractive status between boys and girls?

II. Materials And Methods

This study covers a period of six years (from January'2010 to December'2016).

The survey includes 324 children (648 eyes) from Sofia city and Sofia district(Bulgaria), aged between 6 and 12 months at their first visit and refraction examination. Children are divided by gender (159 girls (318 eyes) and 165 boys (330 eyes)) and are divided into four age groups as follows:

- First group: 6 to 12 months: includes 159 girls (318 eyes) and 165 boys (330 eyes);
- Second group: 12 to 18 months: includes 148 girls (296 eyes) and 157 boys (314 eyes);
- Third group: 18 to 24 months: includes 151 girls (302 eyes) and 159 boys (318 eyes);
- Fourth group: 24 to 36 months: includes 103 girls(206 eyes) and 110 boys(220 eyes);

The number of patients is not exactly the same in the first three age groups, because not absolutely every child is examined in every age period, despite of the given information for the recommended visits. The number of children in fourth age group is much smaller because it includes patients who were not examined between 12

and 24 months or those with higher refractive errors in the previous visits. Still every patient is followed up at least two times at a different age.

These facts do not interfere with the reliability of the data from the statistical processing at all.

The study includes only full-term children without any other ocular pathology.

The presence of astigmatism is accepted only for values > 0.75 dcyl.

The methods used are:

1. PlusoptiX S04 refractometry, operational for children aged at least 5 months. Three sequential measurements were performed for every patient, at every visit, in order to achieve more accurate results. There is enough literature data that the results from PlusoptiX S04 binocular autorefractor were found to agree with a cycloplegic refraction performed by an ophthalmologist regarding astigmatism. For that reason our results are based on photorefractometry without cycloplegia [1]; [2]; [3].
2. Cycloplegia and retinoscopy: when amblyogenic risk factors are detected or when the results in fourth age group are “with-the-rule” astigmatism >1.5 dcyl or oblique and “against-the-rule” astigmatism >1.0 dcyl.
3. Optical correction (if needed).
4. Statistical data processing.

III. Results and Discussion

The following figure presents astigmatism change in the different age groups, regardless of gender:

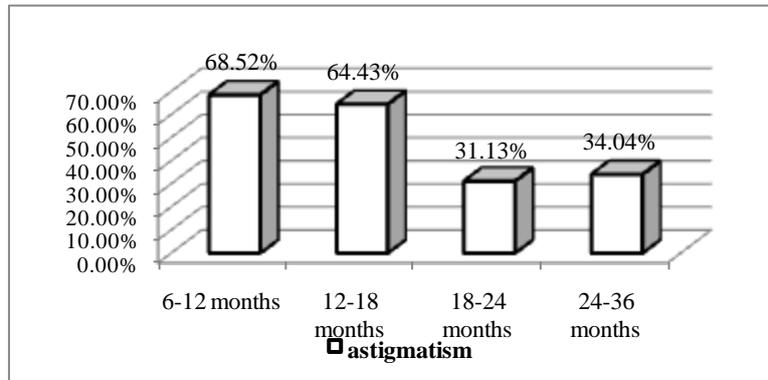


Figure 1: Astigmatism change with age

There is a statistically significant change $p < 0.05$: There is a reduction of astigmatism with age.

Astigmatism is a common refraction in human population and affects about 13% of all people with refractive errors [4];[5]. About 90% of the adults present astigmatism under 1dpt and usually there is no need of optical correction in these cases. In children the frequency of this type of refractive error is about 20% (according to the current study, this percentage is 34.04% for children aged between 2 and 3 years.).

Other authors also have found that astigmatism decreases with age [6]; [7]. The results of the present study come in support of this fact. In some authors’ opinion the change of the astigmatism degree with age is a part of the normal development of the human eye in the process of its emmetropization [8].

Comparing the results above the significant decrease of astigmatism (more than twice) between the first and third age groups could be easily noticed. The following figure presents the degree of astigmatism reduction between these two groups (the change is often not identical between the two eyes of one and the same patient):

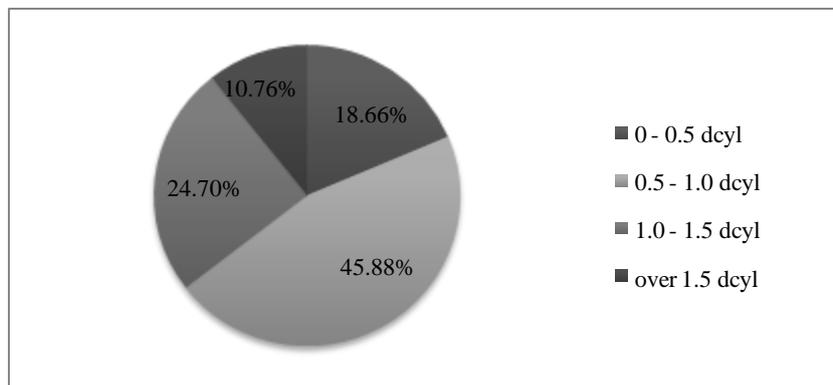


Figure 2: Astigmatism reduction (comparing the results of 6-12 and 18-24 months age groups)

The different degree of astigmatism reduction (up to over 1,5dcyl) actually is the explanation why aspheric refraction should not be immediately corrected with glasses until the age of two.

The next figure illustrates a comparison between boys and girls in the four age groups:

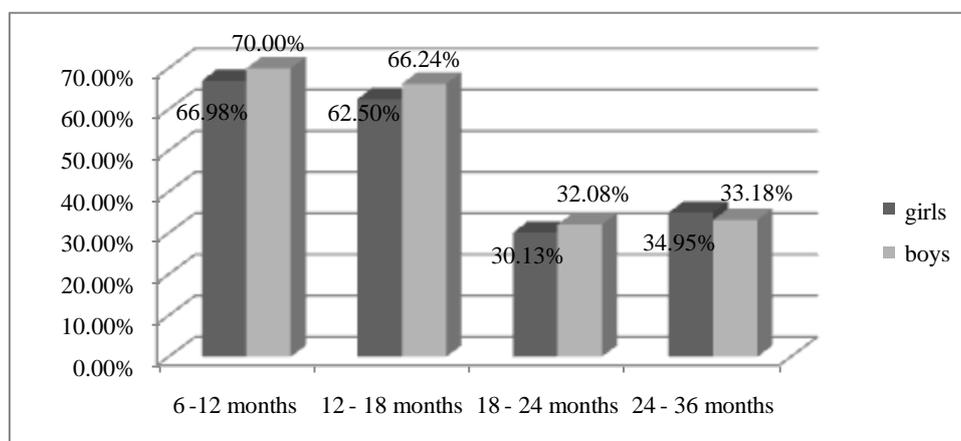


Figure 3: There is no statistically significant difference in astigmatism between genders ($p > 0.05$)

The three main summarized results of the present study are:

1. Astigmatism changes with age (towards reducing);
2. Diopters of astigmatism are most decreased in age between 12 and 18 months;
3. There is no statistically significant difference in aspheric refraction between genders.

IV. Conclusions

The PlusoptiX S04 photorefractometer is a quite accurate method for determining the aspheric refraction in children without cycloplegia. It allows us to state that astigmatism reduces considerably with age. For that reason astigmatism should not be immediately corrected until the age of two. Cycloplegia and retinoscopy should be performed only when amblyogenic risk factors are detected or when the results in children aged 24-36 months are: “with-the-rule” astigmatism > 1.5 dcyl or oblique and “against-the-rule” astigmatism > 1.0 dcyl.

References

- [1] G., Arslan, B., Özsütçü M. et al. Comparison of photorefractometry, autorefractometry and retinoscopy in children. *Int Ophthalmol* (2014) 34: 739.
- [2] Gilmartin L.M. Comparison of the Plusoptix S04 binocular autorefractor with cycloplegic refraction 59 performed by an ophthalmologist L. M. *BIOJ* 2010; 7: 59-61.
- [3] Zhale Rajavi, Hamideh Sabbaghi, Ahmad Shojaei Baghini, Mehdi Yaseri, Koroush Sheibani, Ghazal Norouzi.
- [4] Accuracy and repeatability of refractive error measurements by photorefractometry. *Journal of ophthalmic and vision research*. 2015;10(3) : 221-228.
- [5] Porter J, Guirao A, Cox IG, Williams DR. Monochromatic aberrations of the human eye in a large population. *Journal of the Optical Society of America A-Optics Image Science and Vision*, 18 (8) (2001), pp. 1793–1803.
- [6] Read SA, Collins MJ, Carney LG. A review of astigmatism and its possible genesis. *Clin Exp Optom*. 2007;90(1):5–19.
- [7] Huynh SC, Kifley A, Rose KA, Morgan IG, Mitchell P. Astigmatism in 12-year-old Australian children: Comparisons with a 6-year-old population. *Invest Ophthalmol Vis Sci*. 2007;48:73–82.
- [8] Lai YH, Hsu HT, Wang HZ, et al. Astigmatism in preschool children in Taiwan. *J AAPOS*. 2010; 14:150–4.
- [9] Friling, RWeinberger, DKremer, IAvisar, RSirota, LSnir M. Keratometry measurements in preterm and full term newborn infants. *Br J Ophthalmol* 2004;888-10.