Change in corneal astigmatism with age

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ABSTRACT

The work is theoretical in nature and was created to test the relationship between age and changes in astigmatism. The analysis was carried out on the basis of the available studies described in the literature on the subject. The collected statistical data and medical information allow for the conclusion that astigmatism may change with age. The implemented project presents results that have both cognitive and application value. The identified bindings can be used in the medical practice of patients with astigmatism.

Key words: corneal astigmatism, change, eye changes with age
INTRODUCTION

Astigmatism is an abnormality in the functioning of the optical system of the eye and consists in the different strength of the refraction of parallel light rays in different planes of the optical system of the eye. Consequently, there is no single point focusing the beams of light rays, with the result that the image on the retina is not well focused. Instead, the rays are focused unevenly at several points on the retina and this results in blurred vision both near and far. Depending on which eye structure is abnormal (incoherent), there are different types of astigmatism. The most common is corneal astigmatism, which is the result of an abnormal shape of the cornea. Usually it is straight, less often oblique or inverse. Astigmatism can be caused by genetic as well as environmental factors. There is a lot of research into the genetic factors that influence the development of astigmatism. Hammond et al., in their studies on the relative importance of genes and the environment in refractive error, concluded that the epigenetic factors appear to be important in the inheritance of astigmatism, with a slightly lower overall genetic component of about 50% for astigmatism total and up to 60% for corneal astigmatism [1].

CHANGE IN CORNEAL ASTIGMATISM WITH AGE IN CHILDREN

The prevalence of astigmatism with a minimum of 1 D varies from 30% in the neonatal period to 50% in infancy. It peaks at 60% between the ages of 1.5–2.5 years and decreases to 20–40% in children aged 5 years. The prevalence of incontinence decreases in older school-aged children to about 12–13% [2].

High values of astigmatism are found in infancy, mainly against the rule (ATR, against the rule), because the cornea has a steeper shape than in older children. Poor eyelid tension is also an important factor, which, among other things, was the subject of research by a team of Cambridge ophthalmologists. A study by the aforementioned involving 1,000 children in the age range from birth to age 6 showed that many cases of diagnosed astigmatism detected before age 2 are subject to significant reduction or elimination by age 4. The majority of children before the age of 4.5 years have non-compliant astigmatism and after that age have compliant astigmatism. The higher prevalence of astigmatism in infancy and rarer in school-aged children means that much of the early astigmatism is eliminated between the ages of 1 and 6. Because infants tend to have non-conforming astigmatism, older children have con-forming astigmatism, changes in the astigmatism axis must also occur during this time.

Most studies performed in groups of school-aged children indicate a low prevalence of clinically relevant astigmatism. In most cases, it is astigmatism that follows the rule. Based on long-term observations, it can be concluded that a child who does not have astigmatism in infancy is unlikely to acquire it at a later age, at least until the age of 4–6. [3]. Studies over the past few years have provided an extensive database of refractive change in children of the Tohono O’Odham tribe of Indians, who are found to have a high prevalence of astigmatism at school age. It is due to abnormal corneal structure and almost always follows the rule [4]. A long-term study of corneal astigmatism in 960 Tohono O’Odham children aged 6 months to 7 years showed that during early development (6 months to < 3 years), astigmatism decreased in children with high astigmatism (by -0.37 D/year) and remained stable in children with little or no astigmatism (+0.05 D/year). Between the ages of 3 and 7, astigmatism decreased in children with both high (by -0.11 D/year) and low astigmatism or no astigmatism (by -0.03 D/year). Data collected later on children over the age of 7 suggested that younger children with high astigmatism and children over the age of 11 showed a tendency for astigmatism to increase with age. However, all of the average changes observed were small and not clinically significant [5].

A study of the changing profile of astigmatism in school-aged children in Northern Ireland also found that this refractive defect does not remain constant throughout childhood. Data from Phase 1 of the Northern Ireland Childhood Errors of Refraction (NICER), a population-based study of the prevalence of refractive error in white school-aged children, showed a similarly high frequency of astigmatism in children aged 6–7 and 12–13. Astigmatism values of 1 D or more were significantly associated with myopia and hyperopia. These cross-sectional data do not allow an assessment of how the presence of astigmatism in childhood affects the subsequent development of ametropia. Prospective studies have provided inconclusive results: astigmatism has been shown to be associated with the development of myopia in childhood and its progression, but also that the progression of myopia during the first 3 years is unrelated to the magnitude of lower values of astigmatism (≤2 D). Compared to the large amount of data available on how refractive parameters such as spherical defects change with age, we have too little information on the changing profile of individual astigmatism during the school years, and it is currently unclear whether astigmatism is a cause or effect of ametropia. Few studies, with the exception of surveys in non-white populations, have looked at the prevalence of astigmatism in childhood over the age of 12–13. The current study confirms that the prevalence of astigmatism remains relatively constant both during childhood and after 12–13 years of follow-up. However, the above prevalence data are incon-

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astigmatism, while in older schoolchildren, astigmatism compliant with the rule is observed. With age, there is a shift from astigmatism that is consistent with the rule in young adults to predominance of astigmatism over the rule in adults over 40 years of age. In the elderly, there are changes in the geometry of the cornea, which contribute to the much more frequent incidence of astigmatism against the rule in this age group.

References


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