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Original Research Article

COMPARISON OF OCULAR BIOMETRY WITH OR WITHOUT MYOPIA IN CHILDREN WITH TYPE 1 DIABETES

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Abstract
Background: Refractive errors are one of the most common causes of visual impairment worldwide. Uncorrected, under corrected and undetected refractive errors among school-going children are the most significant problem in developing countries like India. This study was carried out to investigate and clarify the discrepancies between ocular biometry changes in T1DM myope and non-DM myope children in order to fill in these gaps. **Materials and Methods:** The case control research that was done in the ophthalmology department of the medical college and affiliated hospital is the subject of the current ana on the same day, a thorough eye exam was performed on each participant. Eye movement and eyelid health were inspected prior to cycloplegia, the anterior segment was examined with a slit lamp biomicroscope, and visual acuity (VA) was assessed in both eyes using a retro-illuminated logarithmic visual acuity chart. Based on their SE, eyes were divided into one of two groups: those with myopia were those with SE of at least 0.50 D (inclusive), while the remainder were categorised as non-myopic. **Result:** Based on their SE, eyes were divided into one of two groups: those with myopia were those with SE of at least 0.50 D (inclusive), while the remainder were categorised as non-myopic. The mean HbA1c level at the time of the study was 7.65% 5.53% (range 4.9% - 15.5%), while the mean duration of Diabetes Mellitus was 6.21 4.71 years (range 2-14 years) Diabetic retinopathy was not seen in any of the patients. **Conclusion:** Since age was correlated with ACD, LT, AL, SE, HbA1c, and DM duration, age was adjusted besides CCT, K1, and K2 with the multiple linear regression models when there were significant correlations with Pearson correlation.

INTRODUCTION

In India, the prevalence of diabetes mellitus (DM), which affects 11% of the population, has rapidly increased. A significant public health burden in India is diabetic retinopathy (DR), which affects 18.4% of patients with diabetes mellitus (DM). There is significant debate about the pathophysiology of DR.[1,2] The most frequent risk factors for DR are age and the duration of diabetes; however, systemic risk factors for DR, such as blood sugar, haemoglobin A1c (HbA1c), cholesterol, triglyceride, body mass index (BMI), and blood pressure, have also received considerable attention from researchers. However, it is still unclear whether ocular biometrical parameters can influence DR.[3,4]

The most prevalent eye ailment in the world, myopia, is a problem for public health. Myopia is becoming more common, and severe myopia is linked to diseases that could endanger one's vision. By 2050, 10% of the world's population may be myopic, according to meta-analyses, with the remainder experiencing extreme myopia. Studies on both humans and animals carried out over the past 40 years indicate that myopia development may be influenced by both hereditary and environmental variables.[5,6]

The tear film, cornea, crystalline lens, and vitreous are all vulnerable to hyperglycemia in DM patients, which could lead to a decline in optical quality. Children with type 1 diabetes mellitus (T1DM), particularly those who are young, may experience changes without any symptoms. The three most significant determining factors of refraction were axial length, corneal radius of curvature, and lens thickness. There is evidence that adults with T1DM are susceptible to lens damage.[7,8]

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In humans, the lens is tightly packed inside the nucleus, and the insertion of new fibres to the developing cortex after birth occurs slowly. As a result, not only does the lens begin to thin within the first 10 years of life, but the nucleus compaction reflecting a more abrupt rising gradient profile also causes a loss in gradient index power, which in turn causes the lens to lose internal power. Therefore, to preserve refractive condition during childhood, the lens makes up for AL elongation. But because of the internal construction of the lens, myopia can start to appear once it hits its power loss limit.[9,10]

In-depth research is also necessary to understand how children with myopia and T1DM develop their power. Uncertainties regarding lens compensating capability and whether myopia is accelerated in children with T1DM emerged as a result of these worries. This study was carried out to investigate and clarify the discrepancies between ocular biometry changes in T1DM myope and non-DM myope children in order to fill in these gaps.

MATERIALS AND METHODS

The case control research that was done in the ophthalmology department of the medical college and affiliated hospital is the subject of the current analysis. The purpose of the study was to look at the ocular complications of childhood diabetes mellitus. Over the course of a year, the study was completed. Before the study began, the ethics committee and those who needed prior approval were informed. Before being included in the study, the parents received thorough information about it in their native tongue, and they signed an informed consent form.

This study covered T1DM patients who had enrolled within the previous four years. Children who attended to the clinic for routine vision checks and were willing to participate in our study were chosen as healthy volunteers. The sample was eliminated from patients who had additional metabolic diseases and those who were undergoing myopia control treatments. Additionally eliminated were eyes with a history of ocular damage or illnesses.

On the same day, a thorough eye exam was performed on each participant. Eye movement and eyelid health were inspected prior to cycloplegia, the anterior segment was examined with a slit lamp biomicroscope, and visual acuity (VA) was assessed in both eyes using a retro-illuminated logarithmic visual acuity chart.

An autorefractor was used to assess the refractive error and the K1 and K2 keratometry, and the keratometry data was then transformed into average K, K = (K1+K2)/2. Using IOL Master, the ACD, LT, and AL were obtained. After that, 1% cyclopentolate was used to enlarge the pupil, and then subjective refraction was performed. The data on reflection were transformed into spherical equivalents (SE; SE=sphere power+1/2 cylinder power). The modified Bennette-Rabbetts formula was also used to get the lens's (P) refractive power.

Based on their SE, eyes were divided into one of two groups: those with myopia were those with SE of at least 0.50 D (inclusive), while the remainder were categorised as non-myopic. The T1DM group and the control group were then separated into two subgroups for each group. SPSS version 26.0 was used to statistically analyse the data. Standard deviations (SDs) and mean values were employed in descriptive analyses.

RESULTS

There were 152 healthy participants and 160 T1DM patients in the trial. There were 75 male and 85 female patients with T1DM, whereas there were 81 male and 71 female healthy children in the control group. The mean age of the T1DM group was determined to be 14.63 7.44 years, with a range of 6-19 years, and the age of the control group was 13.59 5.93 years, with a range of 6-15 years. When compared, there were no statistically significant age or gender differences between the two groups. The mean HbA1c level at the time of the study was 7.65% 5.53% (range 4.9% - 15.5%), while the mean duration of Diabetes Mellitus was 6.21 4.71 years (range 2-14 years). The mean value of LT in the T1DM group was substantially thicker than that in the control group (5.51 2.20 mm vs. 4.42 2.18 mm, respectively). The ACD of the control group was 4.75 0.56 mm, which was much deeper than the 4.12 0.56 mm of the T1DM group, showing another significant difference between the two groups. There were no significant differences of CCT, K1, K2, AL, and SE in 2 groups.

Diabetic retinopathy was not seen in any of the patients. [Table 1] shows the correlations among each ocular parameter in 2 groups and the correlations between HbA1c or duration of DM and ocular parameters in T1DM group. zACD had a positive effect on AL in both groups, LT had a negative effect on AL in the DM group, and AL had a negative effect on SE in both groups. It was also evident that neither HbA1c nor DM duration were correlated with ocular biometry in the T1DM group.

DISCUSSION

Multisystem problems, including those affecting the eyes, kidneys, nerves, heart, and blood vessels, can result from diabetes mellitus (DM). DM is linked to eye conditions include cataracts, glaucoma, keratopathy, refractive alterations, oculomotor nerve paralysis, and diabetic retinopathy (DR). Despite the fact that DR is the most notable complication and poses the possibility of premature blindness, it is uncommon in children, regardless of the severity and control of DM. Due to the susceptibility of the tear film, cornea, crystalline lens, and vitreous to hyperglycemia in DM patients, the optical quality

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International Journal of Academic Medicine and Pharmacy (www.academicmed.org)
ISSN (O): 2687-5365; ISSN (P): 2753-6556

may be compromised. For children with type 1 diabetes mellitus (T1DM), particularly when they are young, these alterations may not be symptomatic.[11,12]

Myopia is the most frequent treatable cause of vision impairment in the developed world and a major contributor to avoidable blindness in the impoverished world.1 Myopia is the main cause of poor vision in children, and as people become older, their myopia tends to get worse. As part of its global drive to end preventable blindness by the year 2020, the World Health Organization has designated poor vision as a result of uncorrected refractive error as a priority area. Myopia prevalence varies significantly by region in both child and adult populations, with East Asia having the highest frequency—around 80% of young adults there are myopic.[13]

On the one hand, T1DM had a significant impact on the lens, but in the present investigation, CCT, K1, and K2 were unaffected in T1DM youngsters. Because the corneal stroma is a highly hydrophilic structure, it is essential for the epithelium and endothelium to play a role in preventing polarised substances from penetrating the cornea. Additionally, endothelial pumping processes are essential for maintaining corneal dryness. The abnormalities in the epithelium and endothelium brought on by diabetes mellitus (DM) include a reduction in cell number, polymorphism, polymegathism, and an increase in the cellular coefficient of variation, all of which have an impact on the barrier functions. Hyperglycemia is known to impair the Na/K ATPase-dependent transport of endothelial cells. These modifications are predicted to cause corneal hydration and edoema. Regardless of retinopathy status, some prior research revealed a higher CCT in DM patients than in non-DM.

The AL and SE in the current investigation did not reveal any appreciable differences between the T1DM group and the control group. Chinese children between the ages of 7 and 14 normally experience a 0.19 mm decrease in LT, and greater myopia was associated with increases in AL and LT as well as decreases in corneal radius of curvature. Given that the corneal power and AL are rather steady, a higher LT in T1DM children could be a potential risk factor for myopia.

Notably, no correlation between the blood HbA1c level or the length of the disease and the LT, ACD, and the other unaltered measures was observed, despite the fact that LT and ACD were dramatically altered in T1DM children. Our research supported the findings of Uzel et al., who discovered no connection between LT and the HbA1c level in T1DM kids.

CONCLUSION

While the other ocular biometry appeared untouched, we discovered that in T1DM children, LT became larger and ACD decreased, while the overall refractive error remained unchanged. This was interpreted by us as lens refractive index correction. Ocular biometry was unaffected by the length of the DM or the HbA1c level.

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International Journal of Academic Medicine and Pharmacy (www.academicmed.org)
ISSN (O): 2687-5365; ISSN (P): 2753-6556