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The refractive status of children with Down's syndrome in Benin City, Edo State

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Abstract

Background: Down's syndrome is an autosomal chromosomal disorder in humans and individuals with the condition are usually at a risk of various ocular conditions ranging from mild to moderate symptoms compared to those without Down's syndrome. The purpose of this study was to evaluate the refractive status of children with Down's syndrome between 5-18 years.
Materials and methods: This cross sectional study assessed the refractive status of 50 children with Down's syndrome from selected special need schools in Benin City, Edo State, Nigeria. The visual acuity assessed with the use of Lea symbol chart and non-cyclopegic refraction was performed with the streak retinoscope. Hyperopia, Myopia, Hyperopic astigmatism and Myopic astigmatism of 0.25D and above respectively were considered as significant refractive error.
Results: A total of 50 children with Down's syndrome were evaluated; 25 (50%) male and 25(50%) females with a mean age of 12.48 ± 3.028 years. Majority of the participants 45 (90%) had refractive error, with hyperopia being the most prevalent refractive error occurring in 40% (20) of the participants, followed by hyperopic astigmatism 30% (15), then myopia 12%(6) and lastly myopic astigmatism 8%(4) of the total participants. There was no significant relationship between gender and the different types of refractive errors.
Conclusion: Hyperopia was the most common type of refractive error observed in this study. It is necessary that urgent and early eye care services are provided for children with Down's syndrome in the hope of improving their quality of life.

Keywords: Down's syndrome, refractive status, children, hyperopia, myopia, hyperopic astigmatism, myopic astigmatism

Introduction

Down's syndrome is known as a genetic disorder that arise due to an error in the division of cell leading to an additional chromosome 21 which is transported to the new embryo. These additional genes and DNA result in physical and mental developmental changes to the fetus. The extra chromosome can interfere with the physical characteristics, intelligence, and general development of an individual. There could also be a higher risk of some health problems among these individuals. Down's syndrome is present in about one in every seven hundred pregnancies.[1] It is determined by many factors but researchers suggest that women who are over 35 years have a higher tendency of having their pregnancy affected by Down's syndrome than women who become pregnant at a younger age.[2,3,4]
The visual characteristics of children with Down's syndrome have been investigated over the years.[5] Ocular findings in Down's syndrome (trisomy 21) include a wide range of visual anomalies due to refractive errors and amblyopia, strabismus, nystagmus, lid anomalies and infections, amblyopia, corneal ectasias, Brushfield spots, pre-senile cataracts, glaucoma, and retinovascular anomalies.[6,7] Patients with Down's syndrome may develop amblyopia due to strabismus, refractive errors, or media opacities associated to corneal hydrops or cataracts.[8,9,10,11] Children with

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Down's syndrome have been researched over time in connection to the prevalence of refractive error amongst them and this has proven to be at a high percentage of more than 50% in comparison to children without Down's syndrome with a percentage of 5-15%.[6] Although the prevalence rate of refractive error in children with Down's syndrome is reported and confirmed to be higher, ocular diseases has been reported to be low compared to children without Down's syndrome.[12] In order to participate in everyday activities, emphasis must be placed on visual functions as well as the visual acuity. The World Health Organization and Vision 2020 included refractive error as an important consideration for the prevention of childhood blindness. Early ophthalmological intervention and longitudinal care is important for children with Down's syndrome.[5,13] The American Academy of Pediatrics recommends that infants with Down's syndrome be evaluated by a pediatric eye specialist within their newborn period, and subsequently undergo vision exams on a regular basis.[14]

Few studies have reported the visual status of children with Down's syndrome in different parts of Nigeria.[12,15] This study was therefore necessary to determine the refractive status of children with Down syndrome at special needs schools in Benin City, Edo state, Nigeria, as well as to investigate any associations between gender (male and female) and the various forms of refractive error in these children. The findings from this study can aid eye care professionals in effectively managing visual issues pertaining to children with Down's syndrome.

Materials and methods

This cross-sectional study was conducted in two selected special need schools in Benin-city, Edo state, Nigeria. The sample size used for this study was fifty participants identified as having Down syndrome in their school records. There was the characteristic facial appearance that includes a flattened appearance to the face, up slanting palpebral fissures, small ears, a short neck and a tongue that tends to stick out of the mouth. All of these features were present in all the participants for the study.

Ethical consideration

Ethical approval was acquired from the Departmental Research and Ethics Committee of the Department of Optometry, University of Benin in agreement with the tenets of the Declaration of Helsinki.

Procedure

The study procedure was explained in details to the teachers/caregivers of the participants and the participants who could understand the procedure before commencement of the procedures. Detailed case history was obtained from the caregivers of participants containing; name, sex, age, known medical history and participant's visual-learning history. The visual acuity of the participants was measured without wearing their habitual correction (if any) using the Lea Symbol chart at distance 10ft (3m). External examination was carried out using the penlight to check for ocular structures anomalies and pupillary defects. The occluder was used to carry out the alternate cover/uncover test (without prisms) to test for ocular alignment in participants, using a target line above the best VA of the poorest eye; (the subject wore his/her habitual correction for this test if any). Internal examination was carried out using the direct ophthalmoscope in a dimmed environment, it checked the health of the internal structures of the eye to rule out pathology. Objective refraction (non-cycloplegic) was carried out using a streak retinoscope in order to evaluate the refractive status of the children. During the course of examination, children were not responding hence the limited results from children that responded.

Data Analysis

The data was presented in percentages and tables. The chi-square was used to assess the strength of association between gender and the types of refractive error. Statistical investigations were conducted using the IBM statistical test for Social Sciences (SPSS) version 26.0.

Results

A total of 50 participants were examined in this study. This comprised of 25 (50%) males and 25 (50%) females within the ages of 7 to 18 years. The mean age was 12.48 ± 3.25years. Majority of the participants were between 11 and 14 years. The binocular visual acuity of majority of participants (males 40% and females 44%) were within the range of (3/3 – 3/7.5) while only few participants (males 10% and females 6%) had binocular visual acuity within the range of VA (3/8.5 – 3/18). A higher number of females (60%) had hyperopia compared to the male participants. There was no significant association between gender and hyperopia ($p>0.05$). The number of male (32%) and female (39%) participants with hyperopic

Table 1: Distribution of binocular visual acuity

Visual acuity (VA)	Males n (%)	Females n (%)
VA (3/3 – 3/7.5)	20(40%)	22(44%)
VA (3/8.5 – 3/18)	5(10%)	3(6%)

Table 2: Associations between Gender and Refractive Error (Hyperopia)

Variables	Yes	No	P-value
Gender			
Male	8(32%)	17(68%)	0.248
Female	12(60%)	13(40%)	

Table 3: Associations between Gender and Refractive Error (Hyperopic Astigmatism)

Variables	Yes	No	P-value
Gender			
Male	8(32%)	17(68%)	0.758
Female	7(39%)	18(61%)	

Table 4: Associations between Gender and Refractive Error (Myopia)

Variables	Yes	No	P-value
Gender			
Male	2(8%)	23(92%)	0.384
Female	4(16%)	21(84%)	

Table 5: Associations between Gender and Refractive Error (Myopic Astigmatism)

Variables	Yes	No	P-value
Gender			
Male	3(12%)	22(88%)	
Female	1(4%)	24(96%)	0.074

astigmatism was slightly different. There was no significant association between gender and hyperopic astigmatism ($p>0.05$).

A higher number of females (16%) had myopia compared to the male (8%) participants. There was no association between gender and myopia ($p>0.05$). A higher number of males (12%) had myopic astigmatism compared to the female (4%) participants. There was no association between gender and myopic astigmatism ($p>0.05$).

Discussion

The refractive error of children with Down's syndrome has been reported to be more prevalent than that of otherwise normal children with an incident rate of 65% to 100%.[15] This study further confirms the high prevalence (90%) of refractive error among children that have Down's syndrome. The distribution of the refractive error of children with Down's syndrome in the study revealed that the most prevalent form of refractive error was hyperopia, followed by hyperopic astigmatism, myopia, and lastly myopic astigmatism. The distribution of refractive error in this study further supports the study done by Adio and Wajuihan (2012),[12] where more than 42% of the children with Down's syndrome screened had a more prevalent distribution of refractive error, and also in a study conducted by Woodhouse et al., (1997)[16] outside Nigeria, with a total number of 92 infants and children with Down's syndrome showing a larger distribution curve of refractive error. The percentage of this distribution was higher than that found in children and young adults without Down's syndrome.[6,11,13,16] This study was in accordance with the research carried out by Antonela, et al (2011),[17] where hyperopia was discovered to be the most prevalent occurring refractive error amongst children with Down's syndrome and concluded that strabismus could not be attributed to the presence of hyperopia.

Children with Down's syndrome who have a refractive error present in early infancy have a higher tendency of sustaining or increasing the refractive error than outgrowing it.[18] Individuals with Down syndrome are reported to have steeper corneas, and it is believed that the shape of the cornea has an important role to play in the development of hyperopic astigmatism in particular, and hence make this patient population susceptible to keratoconus. Children can also developed oblique astigmatism and is believed to be produced by mechanical induction through the eyelids, according to a study by Al-Baglady, et al (2011).[19]

Statistical analysis of results found out that there is no significant relationship between gender and the different refractive errors found in this study, which is further supported by a studies done by Nwokedi, et al (2018)[15] and Murthy (2012)[20] which showed that the type of refractive error found was not dependent on the gender of the participants, and distribution of refractive error between males and females didn't differ. Down's syndrome individuals require more spectacle correction than the general population as early and frequent evaluation could prevent loss of visual function.[6] Effective solutions for removing the obstacle to refractive error correction in this population of patients must be devised. Comprehensive eye exams, routine vision screenings, follow-ups, and suitable corrective actions are all required by eye care specialists. This can assist in overcoming the burden of visual impairment; improve their social and behavioral challenges thereby enhancing their optimal functioning and quality of

life.[6]

Conclusion and recommendations

Refractive error has been discovered to be a substantial source of vision impairment in children with Down's syndrome. Hyperopia was found to be the most common type of refractive error in this study, followed by hyperopic astigmatism, myopia and myopic astigmatism. There was also no significant association between gender and the different types of refractive error identified. Early detection of refractive error during infancy and early childhood can result in a lower incidence of visual impairment in adulthood. The provision of spectacles will undoubtedly improve their general well-being, education, acceptance, and integration into society. Education of eye care professionals on visual problems of children with Down's syndrome through seminars and conferences will assist in the better knowledge and treatment of this group of children.

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