REFRACTIVE ERRORS AMONG CHILDREN ATTENDING A TERTIARY EYE FACILITY IN IBADAN, NIGERIA: HIGHLIGHTING THE NEED FOR SCHOOL EYE HEALTH PROGRAMS

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ABSTRACT

Background: **It is estimated that 19 million children aged below 15 years are visually impaired globally. Twelve million of these are due to uncorrected refractive errors. The aim of this study was to describe the pattern of refractive errors seen in children attending the eye clinic of the University College Hospital, Ibadan, Nigeria.**

Methods: **A descriptive retrospective study of children with refractive errors seen between January 2011 and December 2012 was conducted. Information on the age, sex, type of refractive error, degree of error (spherical equivalent), presenting complaint, previous spectacle use and return for follow-up visit were retrieved and analyzed using SPSS version 20.**

Results: **Three hundred and sixty-six children diagnosed with refractive errors accounted for 34.6% of all children seen. Of these, 267 (73%) records were successfully retrieved. The mean age was 10.58 (± 3.14) years, with 156 (58.5%) aged between 11 and 15 years. The male to female ratio was 1:2. The commonest refractive error was myopia, found in 124 (23.2%) of 534 eyes followed by simple myopic astigmatism and compound myopic astigmatism found in 117 (21.9%) and 111 (20.8%) eyes respectively. Majority, 229 (85.8%) had never worn spectacles previously and only 80(30%) children returned for a follow up visit.**

Conclusion: **Refractive errors constitute a common diagnosis among children seen in our tertiary eye facility. Late presentation and poor follow up among our patients are a cause for concern. Public enlightenment, health education and school eye programs are recommended to reverse this trend.**

Keywords: Refractive error, Children, Early detection, Visual impairment, Nigeria.

INTRODUCTION

Based on recent figures, it is estimated that 253 million people are visually impaired worldwide, with 36 million people blind while 217 million have low vision.[1] Uncorrected refractive error (URE) is the leading cause of visual impairment (VI) globally (43%), followed by cataract (33%).[2] URE is responsible for 18% of cases of blindness worldwide, second to cataract (39%). Nineteen million children are estimated to be visually impaired globally, and 12 million of these children have URE.[2] In other words, URE is responsible for almost two thirds of cases of visual impairment in children across the world.

Refractive errors include myopia, hypermetropia and astigmatism. They cause defocussing of images formed on the retina of a relaxed eye resulting in poor vision and/or asthenopia (eye strain). Uncorrected refractive errors in children can result in amblyopia, limited or slow academic progress, poor social functioning and impaired quality of life.[3-8]

Refractive errors can be easily diagnosed, measured and corrected. In fact, spectacle correction of refractive errors is considered to be one of the most cost effective interventions in eye care.[3] However, refractive errors often remain uncorrected due to various reasons such as lack of awareness, failure to recognize symptoms in children by parents and teachers, non-availability or inability to afford refractive services and negative attitude to the use of spectacle in children.[7]

In view of the significant burden of refractive errors in children, this study was conducted to determine the frequency and pattern of refractive errors among children attending the eye clinic at the University College Hospital, Ibadan, Nigeria.

MATERIALS AND METHODS

This was a descriptive retrospective study conducted at the Paediatric Ophthalmology clinic of the University College Hospital Ibadan. Clinical records of children aged 1 to 15 years who were diagnosed with refractive errors between January 2011 and December 2012 were retrieved. Information on age, sex, type of refractive error, degree of error (spherical equivalent), presenting complaint, previous spectacle use and compliance with follow up visit were recorded. Visual acuity was measured using appropriate methods based on chronological and developmental age. Preverbal children were assessed with the use of behavioral methods, children aged 3 to 5 years were assessed with Lea's matching test while children older than 5 years were assessed with Snellen's visual acuity chart. Each child underwent a comprehensive ophthalmic evaluation including; pen torch examination of the anterior segment, assessment of ocular alignment, media clarity, and pupillary response, as well as detailed examination of the anterior segment with a slit lamp microscope and dilated fundoscopy to examine the posterior segment.

All children below the age of 5 years had cycloplegic refraction after instillation of 1% Atropine or Tropicamide or Cyclopentolate eye drops. In addition, children aged 5 years and above who had strabismus, and/or refractive errors greater than 3 diopters also underwent cycloplegic refraction. The rest of the children aged 5 years and above had non-cyloplegic refraction.

Objective refraction was obtained by retinoscopy (using a streak retinoscope). Subjective refraction was subsequently performed for verbal children and appropriate spectacle prescription given as required. Subjective refraction was performed immediately (during the same visit) for children who had non-cycloplegic retinoscopy or 1-2 weeks after cycloplegic retinoscopy. The retinoscopy and refraction was performed by a senior optometrist with over 20 years' experience in the refraction of children, while spectacle prescriptions were given by a paediatric ophthalmologist. A follow up appointment of three months was scheduled for each patient to assess spectacle adaptation, compliance with spectacle use and corrected visual acuity. Amblyopia therapy was commenced for children who had amblyopia after three months of spectacle wear to allow for spectacle adaptation.

For the purpose of this study, myopia was defined as a spherical error of ≥-0.5 diopters (D), hyperopia as spherical error of ≥+0.50D, and astigmatism as a cylindrical error of ≥0.75D. Anisometropia was defined as a difference of 2.00D or more between the spherical equivalents of both eyes. Amblyopia was defined as a difference in visual acuity of two Snellen lines between the 2 eyes and cycloplegic refraction as refraction done after paralysis of the ciliary muscle with a pharmacologic cycloplegic agent.

Retrieved data was de-identified and kept confidential. The study followed the tenets of the Declaration of Helsinki. Data was analyzed with the Statistical Package for Social Science version 20 (IBM SPSS version 20; IBM). Descriptive and summary statistics were calculated for appropriate variables. For tests of association, p values < 0.05 were considered significant.

RESULTS

A total of 1058 new patients were seen in our paediatric eye clinic during the 24-month study period. Of these,

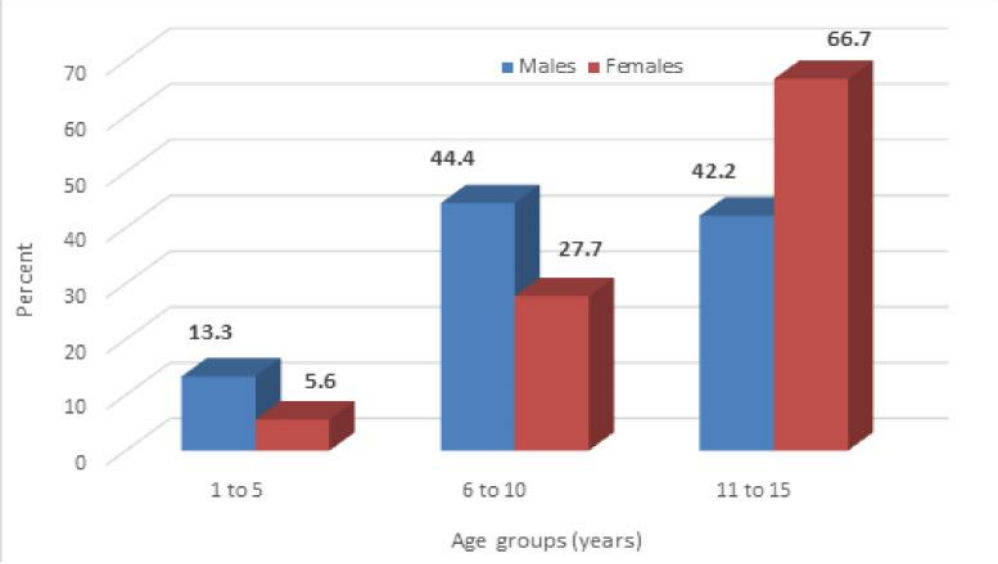

Figure 1: Age and sex distribution of 267 children with refractive errors

Table 1: Frequency of refractive errors in 534 eyes

Refractive error	Frequency	Percentage (%)
Myopia	124	23.2
Simple myopic astigmatism	117	21.9
Compound myopic astigmatism	111	20.8
Hypermetropia	88	16.5
Compound hyperopic astigmatism	43	8.1
Mixed astigmatism	33	6.1
Simple hyperopic astigmatism	18	3.4
Total	**534**	**100**

366 (34.6%) children were diagnosed with refractive error. The clinical records of 267 (73%) of children with refractive errors were successfully retrieved. Females were 177 (66.3%) while males were 90 (33.7%) with a male to female ratio of 1:2. The mean age was 10.58 (± 3.14) years. Majority of the children 156 (58.5%) presented between ages 11 and 15 years. The age and sex distribution of the patients is presented in Figure 1.

The most common presenting complaint was that of poor vision in 191(71%) children. Other presenting complaints included ocular ache, 47(18%) and itching, 16 (6%). Thirteen (5%) children had nonspecific complaints. Previous spectacle use was reported in 38 (14.2%) of the children while only 80(30%) children returned for a follow up visit.

The most common refractive error was myopia which was found in 124 (23.2%) eyes. This was followed by simple myopic astigmatism, 117 (21.9%) eyes and compound myopic astigmatism, 111 (20.8%) eyes. Eighty-eight (16.5%) eyes were found to have hyperopia (Table 1).

Table 2: Type and degree of refractive error based on spherical equivalents* in 534 eyes

Degree# of refractive errors	Diopteric power of refractive errors	Type of referactive error		Total
		Hypermetropic error	Myopic error	
		Number (%)	Number (%)	Number (%)
Mild	≤ 3.00	147 (88.6)	282 (76.6)	429 (80.4)
Moderate	3.25 to 5.75	18 (10.8)	49 (13.3)	67 (12.5)
High	6.00 and above	1 (0.6)	37 (10.1)	38 (7.1)
	Total	166 (100)	368 (100)	534 (100)

** Spherical equivalent refers to the net spherical diopteric power of an eye with astigmatism i.e. the summation of the spherical and cylindrical components of the refractive error of an astigmatic eye.*
 # Degree refers to the severity of the refractive error.

Table 3: Relationship between demographic characteristics and type of refractive error (Based on Spherical Equivalents)

Variable		Type of refractive error		χ^2	p value
		Myopic error n (%)	Hypermetropic error n (%)		
Age groups	1 – 5 years	12 (54.5%)	10 (45.5%)	2.950	0.229
	6 – 10 years	62 (69.7%)	27 (30.3%)		
	11 – 15 years	113 (72.4%)	43 (27.6%)		
Gender	Male	61 (67.8%)	29 (32.2%)	0.330	0.565
	Female	126 (71.2%)	51 (28.8%)		

The spherical equivalents of the patients' refractive errors ranged from +6.00DS to -18.00DS with 429(80.4%) of 534 eyes having a value between -3.00DS and +3.00DS (Table 2). Nine (3.4%) patients had anisometropia.

In the analysis of the distribution of the type of refractive error by age and gender, the spherical equivalent of the eye (right or left) with the higher degree of refractive error was considered for each child. The mean age of children with myopic spherical equivalents was 10.7 (±3.1) years compared with 10.3 (±3.3) years for those with hyperopic spherical equivalents ($p = 0.26$). With regards to the age categories, 72.4% of the children aged 11-15 years had myopic spherical equivalents, compared with 54.5% of children who were between 1 and 5 years old. This difference was not statistically significant (Table 3). In addition, 71.2% of females had myopic spherical equivalents compared with 67.8% of males. This difference was also not statistically significant (Table 3).

DISCUSSION

One-third of the children presenting to our clinic over the 24-month period were diagnosed with refractive error, with majority of them being older children. Errors in the myopic range were the most common and there was a female preponderance. Hospital based studies in different regions of Nigeria among the paediatric age group have reports largely similar to our findings. These studies reported that a third of the children seen had refractive errors.[9-12]

However, Onakpoya *et al.*[13] noted a frequency of 14.3% and in Abakaliki, Onyekonwu[14] found a frequency of 12%. Except for these two reports, refractive errors appear to be quite common among children seen in eye clinics across the country. The reason for the lower figures in the last two reports in comparison to other studies including ours is not clear. This however maybe due to the different sample size in these studies.

The age and gender distribution of the children in our study is consistent with previous reports. A female preponderance has been observed in hospital-based studies in Nigeria,[10,11,13,15,16] Nepal[4] and India.[17] This is in keeping with the observation that the female gender is associated with a higher refractive error burden.[18] Furthermore, it has been suggested that pubertal changes and earlier maturation that occur in girls may explain this observation.[19] In addition, it has been suggested that girls tend to report visual problems more readily than boys.[13]

Majority of our patients were aged between 11 and 15 years. Similar studies by Nwosu *et al.*[16], Onakpoya *et al.*[13], Lawan *et al.*[10], Opubiri *et al.*[11] and Isawumi *et al*[15] found that older children constituted the larger proportion of children who presented to eye clinics with refractive errors. Also, studies conducted in paediatric eye clinics in other countries have reported a similar trend.[4,17] This finding may be due to changes in the refractive state of the eye as children grow as myopic shift is expected in older children. Another explanation, however, may be the better ability of older children to detect and articulate visual symptoms.[13]

Detection of visual problems in older childhood may be facilitated by the increased visual demands of reading for school examinations and the difficulty with seeing the board from the rear of the large classrooms that are often found in secondary schools. On the other hand, it may suggest lack of detection of such problems by parents and teachers of younger children. In fact, the absence of routine screening programs for refractive errors in school children probably contributes to late detection in our environment. Unfortunately, late presentation for treatment has negative implications on the outcome of treatment particularly for children with high refractive errors. This is because older children are beyond the critical age of visual development and, thus, are at risk of poor outcome following amblyopia therapy.

Furthermore, most of our patients had no history of spectacle use despite a mean age of 10.58 years at presentation. This suggests that the presentation to our tertiary facility was their first consultation at an eye clinic. This may be another pointer to the problem of late detection of refractive errors and late presentation for treatment. And it is likely to be a fallout of various factors such as the poor school eye health and refractive error services in our environment, ignorance among guardians and teachers as well as the societal myths that spectacle use in children further damage their eyes.[6,7]

Thus, the need for vision screening programs and school eye health services cannot be overemphasized. This is because the long term effect of amblyopia from uncorrected refractive error on a child's academic performance and therefore, his/her education and career can easily be averted if spectacle correction is instituted in a timely manner.[20] Moreover, there is a need for health education of parents and teachers on the importance of early recognition of refractive errors in children and early correction.

We found myopia to be the most common refractive error in our study, closely followed by simple myopic astigmatism and compound myopic astigmatism. Opubiri *et al.*[11] in South-south Nigeria also observed that myopia was the commonest refractive error among children attending a tertiary eye clinic. Just as Adegbehingbe *et al.*[21] in South-west Nigeria noted in another hospital based study. In contrast, some other hospital based studies in the country have reported astigmatism, especially the myopic form, to be the commonest paediatric refractive error.[10,15,16] Nevertheless, our observation may not be entirely divergent from the latter reports since almost two-thirds of the children in our study had some form of astigmatism.

A poor follow up rate was noticed among our patients with majority not returning for assessment after spectacle prescription. Follow up is particularly important in these children to assess uptake of prescribed spectacles, monitoring of spectacle wear and ensuring that optimal vision is maintained. This is an important area for further research to explore factors that affect adherence to follow up schedule in childhood eye care services. School eye health services may also be useful in ensuring compliance with spectacle wear and improvement of visual function.

The main limitation of this study is its retrospective nature as not all the records of the patients with refractive errors could be retrieved fully.

CONCLUSION

Refractive error is a common reason for ophthalmic consultation among children in our tertiary hospital. A large proportion of patients present in late childhood with majority receiving spectacle prescription for the first time. There is also poor adherence to follow up schedule. Public enlightenment on refractive errors in childhood as well as health education of parents and teachers is essential. School eye health services should be considered as a useful tool for early detection of refractive errors as well as the enhancement of treatment compliance and follow up adherence among children with refractive errors in Nigeria.

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