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Astigmatism among other Refractive Errors in Children of Southern Sri Lanka

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Abstract

The main goal of this study was to find the problem of astigmatism among children with refractive errors who are were in the age group of 3 â?? 14 years. A two stage screening process was envisaged and 5649 children were screened to find visual abnormalities and other defects. Of them, 1233 (21. 8

Index terms— refractive errors, astigmatism, simple myopia, hypermetropia, screening.

1 Introduction

ne important major disease condition that leads to visual failure and related symptoms such as headache, and asthenopia include refractive errors of light rays entering the eyes.

The refraction of light means, when the rays of light travels through air, and enter a denser transparent medium the speed of light is reduced and the light rays proceed at a different angle (bending of rays) the light is hence called refracted. The ray of light, if incident perpendicularly to the denser medium, it does not bend but only reduces the speed.The refraction power of the light is derived from the index of refraction of various parts of the eye through which light passes in to the eye.

When the light from an object reaches the eye it has to pass the cornea, aqueous humor, crystalline lens and vitreous humor to get at the retina where the stimulus of light ray is converted to neuro-electrical impulses. (Andcea 1987) The curvature of the cornea and the lens play an important role in the refraction of the light. The cornea contributes approximately two thirds of the refractive power and the lens contributes about one third of the refractive power of the eye. The cornea has the index of refraction of 1. 376 and lens has the average of 1.41.The total power of the eye does not equal to the sum of the power of the cornea and the lens because they are separated at aqueous and vitreous interfaces and it is around + 58 diopters. The curvature of the human lens could be altered using the circular cilliary muscle and its refractive state could be actively changed according to the need.

When the refraction of the eye does not take place accurately to focus the rays on to the macula area of the retina, the condition is called the refractive error (AMETROPIA). In an eye with a refractive error the parallel light rays that come in to the eye will therefore focus in front or behind the plane of the retina when the eye's optical system is at rest. This process will result in the blurring of the image. In a schematic eye a 0.3mm shift in the focal place needs a correction of one diopter.

The optical system described above assumed to have spherical structures. That means all meridians of curved structures have equal spheroidal surfaces. Many optical systems in the eye are however are not so and resembles a toric surface. In a toric surface the curvature varies in different meridians. In such instances the light rays passing through steep meridians will be more deflected than rays which pass through flatter meridians. This is a complicated process and will result in defocusing the part of the object from which the light rays pass in to the eye through anomalous meridian. This condition is called Astigmatism.

Corneal toricity is the cause of most of the Astigmatism. Astigmatism could be simple myopic or hypermetropic depending on where the ammetropic rays get their focal point. If the part of the rays is focused in front of the retina, it is called myopic astigmatism. When part of the rays is focused behind, it is called hypermetropic stigmatism. When only one meridian is ammetropic (either myopic or hypermetropic) it is called simple myopic

or hypermetropic astigmatism.In the mixed type of astigmatism one principal meridian is myopic type and the other one is hypermetropic type. When both meridians are ammetropic, it is called compound astigmatism. If both meridians are hypermetropically deviated differently it is called compound hypermetropic astigmatism and if the same entity happens myopically the condition is called compound myopic astigmatism. In mixed type of astigmatism one meridian becomes hypermetropic whilst the other is myopic.

Astigmatism is again classified as regular or irregular. In the regular type the principal meridian are ninety degrees apart. (Perpendicular to each other). In irregular astigmatism the principal meridians are not perpendicular. Most astigmatisms are regular type. (Gary Heitingod) (Jackson ans Finlay 1985)

Refractive errors among children could be easily detected and treated. Delay in seeking treatment lead to significant ocular morbidity including amblyopia, low vision and poor quality of life (Resinikoff 2004) Having recognized the importance of the prevention of low vision, the 66th world health assembly initiated a global action plan for 2014 -2019 to promote universal eye health. This plan requests member states to take measures to reduce avoidable visual impairement by 25% by the year 2019 (WHO 2013) (Deborah 1985) Astigmatism can be corrected with special type of lenses called toric lenses. In a toric lens one meridian is more curved than all other meridians. The meridian of least curvature and greatest curvature are always at right angles in a toric lens. Toric lenses can be plus lenses (to correct hypermetropic astigmatism)or minus lenses (to correct myopic astigmatism) Toric lenses are called sphero-cylinders, in which the power of the lens act only perpendicular to its axis.

Clinically people with astigmatism experience headache, fatigue of eyes after work, eye strain and blurred vision at distances. These symptoms may not necessarily due to astigmatism only but exclusion of astigmatism is important in people with such symptoms.

2 II.

Objective of the Study 1. To find the prevalence of astigmatism among school children and its different types.

3 a) Study setting

One of the health unit areas of Galle(Bop-Poddala) district was selected for this study. All children of 3 -14 years were taken as study subjects.

b) The study design

The study design included three stages. In stage one the primary visual screening at schools, pre schools and in the community was done. The positive cases difficult cases, refusals and absentees were re screened at stage two screening in the field. The selected cases from second screening were referred to a third stage complete ophthalmological examination for diagnostic and treatment purposes at a well equipped eye clinic.

Primary and secondary screening of children was done by trained, medically qualified doctors with the help of the chief investigator in the field. The third stage examination was done by the ophthalmic qualified principal investigator. The health department field staff helped in other activities like finding subjects from the community, schools and pre schools.

4 III.

5 Results

6 a) Coverage of subjects

7 Screening of children

8 Schools

Pre schools /community IV.

9 Discussion

The main aim of this study was to highlight the astigmatism in Sri Lankan children including other types of refractive errors. Uncorrected refractive errors can hamper the performance at schools and lead to various symptoms such as headache, pain in the eyes and aesthenopic symptoms.

A study among children aged 5 -17 years from Asia, Afro America, Hispanics and Whiles revealed that Asians had the highest age and sex adjusted prevalence of myopia (18.5%) and astigmatism (33.6%) (Kleinstein, Lee, and Zadnik 2003)

A study conducted among 7 -15 years old children (N = 44.4) in a rural population of India showed that the couse of visual impairement is mainly refractive errors and it was 61%. **??**Dandona et al 2002) Another study done in Hydrabad India in children aged 3 -18 years revealed astigmatism of 10.3% (Kalikirani, Naduvilath, Bantal and Dandora 1997). Seimon (2005) analysed the prescriptions issued by over 150 optometrists that includes children <15 years over a period of one year and found that 5612 children had sought correction for all kinds of refractive errors.

In this study the total sample of children between 3-14 years was 5649, representing the children of same age group living in southern Sri Lanka. Of them1233 (21.8%) were selected for further second stage screening using the Snellen's chart and direct examination of the anterior segment. Those selected cases included the first stage screen failures and the difficult to screen cases. For the second stage 98% of referred cases attended and of them 512 children were qualified for the third stage examination. After the examination, 439 cases were confirmed having an ophthalmological diagnosis, giving a prevalence of 7.8% (78/1000).

The analysis of different disease conditions gave the prevalence of Refractive errors of 6,2%(62/1000) and other eye conditions of 1.6% (16/1000).Table 1.

The analysis of the distribution of Refractive errors showed 2.3% (23/1000)of unilateral involvement and 3.9%(39/1000) of bilateral refractive errors in children.-Tables2, 3, & 4.

The prevalence of total simple myopia (bilateral and unilateral) was 1.65% (16.5 / 1000). Simple hypermetropia 0.95 (?.1.0% or 10 / 1000)

The astigmatism in children is the main concern of this paper and the the analysis showed a prevalence of unilateral Astigmatism of 1.5% or 15/1000 compared to total unilateral refractive errors of 23/ 1000 in children. The prevalence of bilateral astigmatism was 21/1000 compared to total unilateral refractive errors of 39/1000.In the calculation In the calculation of total Astigmatism, the average of bilateral similar types were considered-Table **??**.

The average Astigmatism calculated was 59.0%of all Refractive errors and the most prevalent form of Astigmatism in school children was found to be Myopic Astigmatism, which amounts to 45.7% of all refractive errors. As a prevalence the Myopic Astigmatism alone was 2.8% (28/ 1000)either unilaterally or bilaterally in school children in southern Sri Lanka making it the most common form of refractive error.

This study highlights that the refractive errors constitute a considerable amount of visual problems among children. Among all refractive errors in Sri Lankan children Astigmatism constitute a bulk. Although Sri Lanka has a well established primary health care system, the burden of refractive errors implies that further consideration in to the issue of screening is needed.

1

School children year 1 -9	Pre school children
Total No 6685*	Total No 934**
Number attended for screening	Number attended755
(74.8%) 5001	(80.8%)
Excluded (Above 15yr) 38 (0.57%)	Excluded 69 (7.4%) (inability to check VA
Included to study 4963 (74.2%)	Included to study 686 (73.4)

Figure 1: Table 1 :

2

Distribution	Eye		Prevalence
Unilateral	Right	40	0.7%
	Left	88	1.6%
Bilateral		223	3.9%
Total		351 eyes	6.2%

Figure 2: Table 2 :

3

Types of refractive errors	Different types -unilateral involvements				Total		Prevalence N=5649
	Right		Left				
	No	%	No	%	No	%	
Simple myopia	8	20.5	23	25.8	31	24.2	0.5
Simple Hypermetropia	9	23.5	7	7.9	16	12.5	0.3
Myopic Astigmatism	16	41.0	51	57.3	67	52.3	1.2
Hypermetropic Astigmatism	2	5.1	1	1.1	3	2.3	0.05
Compound Myopic Astigmatism	-		2	2.2	2	1.6	0.04
Compound Hypermetropic Astigmatism	2	5.1	1	1.1	3	2.3	0.05
Mixed Astigmatism	2	5.1	4	4.5	6	4.7	0.11
Total	39	100	89		128	100	
Prevalence (N=5649)		0.7%	1.6%				2.3%

Figure 3: Table 3 :

4

Type	Bilateral involvements						
	Right		Left			Total	Prevalence
	N0	%	N0	%	N0	%	%
Simple myopia	64	28.7	66	29.6	130	29.1	1.15
Simple Hypermetropia	41	18.4	34	15.2	75	16.8	0.65
Myopic Astigmatism	83	37.2	91	40.8	174	39.0	1.55
Hypermetropic Astigmatism	9	4.0	10	4.5	19	4.3	0.15
Compound Myopic Astigmatism	17	7.6	14	6.3	31	7.0	0.25
Compound Hypermetropic Astigmatism	-	-	1	0.4	1	0.2	0.01
Mixed Astigmatism	9	4.0	7	3.1	16	3.6	0.15
Total	223	100	223	100	446 eyes		
Prevalence (N=5649)			3.9%				

Figure 4: Table 4 :

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