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ORIGINAL RESEARCH

Uncorrected Refractive error and Amblyopia: Our Reports

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ABSTRACT

Uncorrected Refractive error is an avoidable cause of visual impairment especially among children. Uncorrected refractive error is one of the important causes of amblyopia that exposes children to poor school performance. In this young population, amblyopia had caused severe unilateral impairment of vision 10 times more frequently than all other diseases and trauma This in later adulthood may refrain them from working resulting in severe social and economic losses. It is difficult to assess the frequency of amblyopia in the general population. Increased attention paid in recent years by the media and medical community to early detection of uncorrected refractive error has decreased the prevalence of amblyopia. So early detection and treatment of uncorrected refractive error remains ideal goals to strive for, as documented by this study and other population-based studies. **Context:** Uncorrected refractive error is one of the important causes of amblyopia among young children's and if not detected timely, may lead to deterioration of quality of life and other psychosocial difficulties to children affecting individual's self-image, work, school and friendship. **Aims:** To determine the prevalence and pattern of uncorrected refractive error in school going children and to study association between degree of anisometropia and severity of amblyopia. **Settings and Design:** Hospital based cross sectional study carried on 500 school going children up to 10th grade selected by non-probability convenient sampling according to the inclusion and exclusion criteria. **Methods and Material:** The clinical profile of these children was evaluated in department of ophthalmology, P.D.U Govt. medical college, Rajkot and they underwent detail visual assessment and ophthalmic examinations including measurement of uncorrected visual acuity, best corrected visual acuity, auto-refraction, retinoscopy, subjective correction and detailed squint evaluation, if present. during period of November 2019 to February 2021 under school health programme. All selected school going children were referred from different schools after primary screening at school as a part of school health programme. Valid informed consent was taken from patient's parents/ guardians.If uncorrected vision was <6/12 in either eye, the child was declared to have defective vision. **Statistical analysis used:** We estimated prevalence of uncorrected refractory error using parametric methods and bivariate type of analysis. To validate the data, we calculated frequencies, percentage and their 95% confidence interval. Statistical association was done using chi-square test and p-value was determined. **Results:** Total of 500 school going children were enrolled in the study, out of which 221(44.2%) were females and 279 (55.8%) were males. The mean age of children was 9.81± 2.72 years (range, 6 to 14). The prevalence of uncorrected refractive error was 28% (140 children out of 500 children). Astigmatism was most common refractive error with prevalence of 73.57% (n=103) (95% CI, 3.12-6.54). The prevalence of myopia and hyperopia in our study was 15% (n=21) (95% CI, 5.34-5.45) and 11.2% (n=16) (95% CI ,2.37-2.78) respectively. Girls were more often myopic as well as hyperopic than boys which was statistically significant (p=0.031). Approximately 93.2% (n=96) (95%CI, 2.14-5.89) patients were having small astigmatism (0.5D-1.5D), while remaining 6.8% (n=7) (95% CI, 1.78-3.45) had high astigmatism (≥ 1.5D). There was no statistically significant difference between gender(p=0.67) and age groups (p=0.41) in case of high or low astigmatism. 80.58% (n=83) (95% CI, 2.18-3.56) patients had with the rule astigmatism, while 19.42% (n=20) (95% CI, 1.67-3.44) patients had against the rule astigmatism. With advancing age WTR astigmatism shows an increasing trend while ATR astigmatism shows a decreasing trend. In our study, prevalence of amblyopia was 8% and Hypermetropia was the most common refractive error 66.67% (n=20) (95% CI, 3.11-5.14) in amblyopic eyes followed by Myopia 20% (n=6) (95% CI, 2.12-4.78) in anisometropic and ametropic amblyopia. 13.33% patients (n=4) had meridional amblyopia. Children with mild to moderate degree of amblyopia were seen more in hyperopia comparison to myopic patients and the difference was statistically significant(p=0.03). Only one patient had severe unilateral amblyopia due to anisomyopia of > 6D spherical equivalent. In our study, we found depth and prevalence of amblyopia increased as the degree of anisometropia increased and it was found to be statistically significant(p=0.045). **Conclusions:** The following study highlights that prevalence of refractive error among school going school children is very high and uncorrected refractive error is now emerging to be commonest cause of amblyopia among school going children.Early detection of amblyopia and institution of appropriate therapy is of immense value towards preventing the prevalence of life long visual morbidity due to uncorrected refractory error. The data in the present study could be used to enhance screening efforts in an organised manner in those health-care groups which come in regular contact with infants and young children. This includes village health workers, personnel at mother and child care clinics, paediatricians both in practice and in referral hospital services and general practitioners associated with school health programmes. They could also be trained to assess visual acuity in very small children with

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Cardiff or Teller's visual acuity charts. Providing spectacles at a low and affordable cost to school going children as a part of school health programmer can prevent a major proportion of visual impairment.

Key-words: Uncorrected refractive error, amblyopia, visual- impairment, anisometropia

Key Messages: Large percentage of uncorrected refractory error goes undetected among school going children due to lack of access to health care facilities. Effort could be directed towards strengthening vision screening programmes in schools and mother and child care clinics and training village health workers to assess for visual impairment and prevent the lifelong morbidity

INTRODUCTION

Refractive error could be considered as an avoidable condition among various conditions leading to visual disabilities in children and uncorrected refractive error have been identified as leading cause of visual impairment in many age groups across the globe[1]. A World health organization report states that approximately 43% of visual impairment is attributable to uncorrected refractive errors [4,6]. Uncorrected refractive error impairs the quality of life of million of people of different ages, gender, ethnicities and they impose heavy burden on the families of affected individuals as well as the society as a result of loss of manpower. Moreover, uncorrected refractive errors at younger ages can lead to one of the most dramatic sensory anomalies common in younger ages with uncorrected refractive error and strabismus is the low visual acuity in one of the eyes, known by the term amblyopia which negatively affects their educational, occupational and athletic performances [3,4,6]. Different factors contribute to development of refractive errors, these include genetics, environmental factors and socio-economic status.

This term amblyopia literally means “dullness of the vision” (G.ambly dull, + ops,vision, sight).[1] In this meaning amblyopia is defined as a decrease of visual acuity in one eye when caused by abnormal binocular interaction or occurring in one or both eyes as a result of pattern visual deprivation during visual immaturity, for which no cause can be detected during the physical examination of eyes and which in appropriate cases is reversible by therapeutic measures.[1,3,4]

Albercht von graefe has defined amblyopia as a condition in which the observer sees nothing and the patient very little. Most sensitive age children are sensitive to amblyopia is first 2 to 3 years of life and thus sensitivity gradually decreases until child reaches 6 or 7 years of age.[1,5]

Amblyopia as defined is a growing socioeconomic problem. It is difficult to assess the frequency of amblyopia in the general population. They vary from 1% to 3.2% among military recruits, to 0.5% to 3.5% in preschool and school age children, to 4.0% to 5.3% in patients with ophthalmic problems[1,4,5]. From this one can reasonably assume 2.0% to 2.5% of general population has amblyopia.

Amblyopia occurring due to presence of uncorrected refractive error is known as refractive amblyopia.

It can be of following subtypes [1]: -

1. Anisometropic amblyopia: - refers to amblyopia occurring in eye having higher degree of refractive error than the fellow eye.

Frequently anisometropia is associated strabismus and to determine weather amblyopia is due to strabismus, the anisometropia or perhaps both is difficult. Anisometropic amblyopia is due to sensory interference caused by superimposition of focused and defocused image originating from fixation point. As a result of this binocularity elicited foveal inhibition, visual acuity of anisometropic eye is lower under binocular conditions than when tested monocularly. If anisometropia is optically corrected, the resulting aniseikonia may be another amblopiogenic factor, since retinal images of different sizes may also present. The degree of anisometropia correlated well with severity of amblyopia. As a rule, amblyopia is more common and of higher degree in patients with anisohypermetropia (1.5 D to 2D) than in those with anisomyopia.[1,4] The retina of more ametropic eye of pair of hypermetropic eyes never receive a clearly defined image, since with details clearly focused on the fovea of better eye, no stimulus is provided for further accommodative effort required to produce clear image in the fovea of the more hypermetropic eye. When myopia is unequal, the more myopic eye can be used for near work and less myopic eye for distance. Therefore, unless the myopia is of higher degree (-6D or more), both retinas receive adequate stimulation and amblyopia dose not develop.

2. Ametropic amblyopia :- In bilateral uncorrected hypermetropia (+5D or more) or astigmatism (1.25D) , a milder and usually reversible form of amblyopia is seen known as ametropic amblyopia.[1,6]
3. Meridional amblyopia. :- Selective visual deprivation of visual stimuli of certain spatial orientation is caused by uncorrected astigmatism (1.25D or more) known as meridional amblyopia. [1]

Most of the children with uncorrected refractive error are asymptomatic and hence screening helps in early detection and timely interventions.

Psychosocial difficulties related to amblyopia affect an individual’s self-image, work, school and friendships. These consequences of untreated amblyopia must be explained to the parents so that they can make an informed choices about necessity of treatment. [1.2,3,4]

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We are convinced that in countries like India, with high attendance of children in schools, integration of vision screening within screening of other health issues is recommended. once a timely diagnosis of uncorrected refractive error and amblyopia is to be made, it is a professional as well as ethical duty of practitioner to institute treatment.[3,5]

The present study was conducted to determine the prevalence of uncorrected refractive error among school going children during school health programme, so that early detection and intervention in form of spectacles can be done and also to identify those children who developed amblyopia due to uncorrected refractory error and to study association between degree of anisometropia with severity of amblyopia.

SUBJECTS AND METHODS

This was a cross sectional hospital based study carried on 500 school going children up to 10th grade, selected by non-probability convenient sampling according to the inclusion and exclusion criteria. The clinical profile of this children was evaluated in department of ophthalmology, P.D.U Govt. medical college, Rajkot and they underwent detail visual assessment during period of November 2019 to February 2021 under school health programme. All selected school going children were referred from different schools after primary screening at school as a part of school health programme. Valid informed consent was taken from patient's parents/ guardians.

INCLUSION CRITERIA

Children till 10th standard class who were referred from school under school health programme coming to OPD of GT SHETH Eye hospital, PDU Medical college, Rajkot was included in the study.

EXCLUSION CRITERIA

A patient with any other ocular pathology (both anterior and posterior segment) was excluded from the study.

Each of the patient referred under school health programme was assessed in detail about:

1. Patients' basic details like name, age, sex, address, school, standard, and registration number of patients outdoor cases were recorded.
2. The assessment included a detailed history related duration of diminution of vision as noticed by the patient, age of presentation to the hospital, onset of squint, if any the subsequent clinical course, and any previous modality of treatment taken.
3. History elicited about trauma, foreign body fall or other ocular pathology especially corneal pathology and treatment either medical or surgical taken if any for the same.
4. Any significant birth history or any other systemic illness like diabetes, hypertension, asthma, ischemic heart disease, any drug reaction, any addiction, etc. are elicited.
5. Family history of amblyopia or strabismus if it is present or not.
6. Patient's visual acuity and best corrected visual acuity were recorded with each eye separately by optometrists, using well illuminated Snellen's visual acuity chart with patient sitting at distance of 6 meters. If uncorrected vision was <6/12 in either eye, the child was declared to have defective vision.
7. Refraction under appropriate cycloplegics depending upon age of the patient followed by streak retinoscopy, assessment of ocular alignment, ocular motility, and associate deviations if any was done.
8. Squint examination if any, was done with Hirschberg's test and confirmed by cover uncover test and also angle of deviation measured with prism bar cover test and krimsky's prism test was done , and then assessment of the binocular status of the eye was performed whenever possible with help of worth's four dot test done.
9. Patients anterior segment examination was done with help of slit lamp bio microscopy to rule out anterior segment pathology by ophthalmologist.
10. A detailed fundus examination was done by ophthalmologist to rule out any posterior segment pathology and to determine the fixation pattern.

Patients with visual acuity of 6/6 and with retinoscopic readings that confirmed the absence of refractive error were excluded from further refraction procedures.

Myopia was considered when the measured objective refraction was equal to or greater than -0.50 spherical equivalent in one or both eyes. Hyperopia was considered when measured objective refraction was greater than +1.0D spherical equivalent diopters in one or both eyes provided no eye was myopic.

Unilateral amblyopia in our study was defined as a 2-line difference between eyes with VA<6/18 in the worse eye and with coexisting anisometropia [≥1.00 D spherical equivalent (SE) for hyperopia, ≥3.00 D SE for myopia, and ≥1.50 D for astigmatism], strabismus, or past or present visual axis obstruction. Bilateral amblyopia was defined as VA in both eyes <6/18, with coexisting hyperopia ≥3.00 D SE, myopia > 6.00 D SE, and astigmatism ≥2.50 D, or past or present visual axis obstruction.

Categorization on basis of severity of amblyopia was done based on Best corrected visual acuity on Snellen's vision chart for distance as Mild amblyopia (BCVA 6/9 to 6/12), Moderate amblyopia (BCVA 6/12 to 6/36), Severe amblyopia (BCVA ≤ 6/36).

The data was entered in Microsoft excel spreadsheet after ensuring completeness of the filled forms. Analysis was done using the Statistical Package for social science (SPSS 10.0.5) (SPSS Inc. Chicago, USA).

W estimated prevalence of uncorrected refractory error using parametric methods and bivariate type of analysis. To validate the data, we calculated

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frequencies, percentage and their 95% confidence interval. Statistical association was done using chi-square test.

All children with uncorrected refractive error were given spectacles at low cost. Children who were detected with amblyopia were referred to higher centre for further evaluation and management.Follow-up measures and response to treatment instituted in these patients after starting therapy is outside the preview of this report.

RESULTS

Total of 500 school going children were enrolled in the study, out of which 221(44.2%) were females and 279 (55.8%) were males. The mean age of children was 9.81± 2.72 years (range, 6 to 14). The prevalence of uncorrected refractive error was 28% (140 children out of 500 children). Out of 140 children with uncorrected visual acuity, 103 children (73.46%) had normal visual acuity in at least one eye and and 37 children (26.54%) were having defective vision in both eyes.

In all 140 children's cycloplegic refraction was carried out with cyclopentolate 1% eye drops at every 10 min interval for 3 times followed by streak retinoscopy and then post mydriatic subjective correction done to determine the best corrected visual acuity. After subjective refraction was performed to achieve best corrected visual acuity, bilateral defective vision was reduced 2.5% (n=13) and unilateral defective vision was reduced to 3.9%(n=17) and no child was bilaterally blind in our study.

The prevalence of myopia and hyperopia in our study was 15% (n=21) (95% CI, 5.34-5.45) and 11.2% (n=16) (95% CI ,2.37-2.78) respectively. Among the myopes (n=21), 76.4%(n=16) (95% CI, 1.67-2.97) were female and 23.6% (n= 5) (95% CI, 2.43-4.13) were male. Unilateral myopia was seen in 66.98%(n=14) children, while 33.02%(n=7) had bilateral myopia. Myopia was seen more in females' comparison to males, but difference was not statistically significant (p=0.61).

Among hyperopic, (n=16), 60.33% (n=10) (95% CI, 2.31-3.45) were female and 39.67% (n=6) (95%CI, 1.21-2.13) were males. Unilateral hyperopia was seen in 64.24% (n=11) children, while 35.76% (n= 5) had bilateral hyperopia. It was found in our study that in girls were more often hyperopic than boys which was statistically significant (p=0.031).

The prevalence of astigmatism was 73.57% (n=103) (95% CI, 3.12-6.54). Approximately 93.2% (n=96) (95%CI, 2.14-5.89) patients were having small astigmatism (0.5D-1.5D), while remaining 6.8% (n=7) (95% CI, 1.78-3.45) had high astigmatism (≥ 1.5D). There was no statistically significant difference between gender(p=0.67) and age groups (p=0.41) in case of high or low astigmatism. 80.58% (n=83) (95% CI, 2.18-3.56) patients had with the rule astigmatism, while 19.42% (n=20) (95% CI, 1.67-3.44) patients had against the rule astigmatism. With advancing age WTR astigmatism shows an increasing trend while ATR astigmatism shows a decreasing trend

Table 1: - Age wise distribution of type of astigmatism

Age groups (in years)	With the rule astigmatism	Against the rule astigmatism	Oblique astigmatism	95% Confidence interval
5-7 (n=48)	78.5%(n=38)	12.8%(n=6)	8.3%(n=4)	8.98-13.8
8-10 (n=30)	81%(n=24)	11% (n=3)	8% (n =3)	3.67-6.45
11-14 (n=25)	84%(n=21)	12% (n=3)	4%(n=1)	4.56-5.65

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Table 2: - Distribution of patients with astigmatism according to refractive types.

Type of astigmatism	Number of patients	95% Confidence interval
Myopic astigmatism (simple and compound)	63 (60.81%)	4.31-5.23
Hypermetropic astigmatism (simple and compound)	36 (34.93%)	1.23-3.53
Mixed astigmatism	4 (4.23%)	3.42-5.43

Myopic astigmatism (60.81%) was more prevalent in children's than hyperopic astigmatism (34.93%) and this difference was statistically significant (p=0.034).

Initially 400 children were screened for amblyopia in first visit and 32 students were found to be amblyopic, 100 children in first visit were too uncooperative to allow proper examination. These kids were subsequently screened in second visits after 6 months and among those 100 children, 12 were found to have amblyopia. Hence, prevalence of amblyopia was 8% in first visit, but after completion of the study it came around 8.8%. The variation in the prevalence during study was due to difference in the number of the subjects enrolled in the study due to subjects being uncooperative for evaluation.

There was no significant difference in incidence and prevalence of amblyopia in different age groups (p=0.81) and no significant gender difference(p=0.49). However, majority of amblyopic patients belong to age group 10-11years (n=11). Amblyopic children were significantly older (9-11 years age) than non-amblyopic children (6-9 years age) (P=0.004). Mean age of presentation of amblyopia was 10.6 years.

Among the total 44 amblyopic patients, 59.1%(n=26) were unilateral cases and 40.9%(n=18) were bilateral

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cases. In both unilateral and bilateral cases, Underlying causes included anisometropia combined with strabismus 36.6%(n=16), strabismus (29.55%), anisometropia 22.73%(n=10), meridional 9.1%(n=4) and sensory deprivation (2.27%).

In our study, Hypermetropia was the most common refractive error 66.67% (n=20) (95% CI, 3.11-5.14) in amblyopic eyes followed by Myopia 20% (n=6) (95% CI, 2.12-4.78) in anisometropic and ametropic amblyopia. 13.33%, patients (n=4) had meridional amblyopia which was unilateral and milder in nature; due to astigmatism greater than 1.5D.

Approximately 87% (n=26) cases of refractive amblyopia are unilateral, while 13%(n=4) cases were bilateral amblyopia.

Table 3: Distribution of patients according to depth of amblyopia

Depth of amblyopia (visual acuity with correction)	Percentage (%)	95% Confidence interval
6/9-6/12 (Mild)	53.36% (n=16)	3.98-6.87
6/12-6/36)(Moderate)	43.36%(n=13)	1.98-4.65
≤ 6/36 (Severe)	3.27% (n=1)	6.91-9.12

Out of 30 patients, 64%(n=20) children were female, ten girls had mild amblyopia and ten had moderate amblyopia. Remaining 36%(n=10) were male in which six boys were having mild amblyopia and three boys were having moderate amblyopia and only one boy had severe amblyopia. There was no significant gender difference(p=0.51) in distribution of depth of amblyopia among male and female in our study.

Children with mild to moderate degree of amblyopia were seen more in hyperopia comparison to myopic patients and the difference was statistically significant(p=0.03). Only one case of severe unilateral amblyopia was there due to uncorrected refractive error greater than 6D spherical equivalent in amblyopic eye. Four patients had meridional amblyopia (≥ 1.5D uncorrected astigmatism), in which hyperopic astigmatism showed greater number of cases than myopic astigmatism and this difference was statistically significant (p=0.011).

Table 4: Distribution of Depth of amblyopia according to type of refractive error.

Type of refractive error	Depth of amblyopia (Visual acuity with correction)			95% Confidence interval
	6/9-6/12	6/12-6/36	<6/36	
Myopia	2	3	1	1.34-2.65
Hyperopic	12	8	0	3.56- 4.76
Myopic astigmatism	1	0	0	2.98-4.45
Hyperopic astigmatism	1	2	0	3.98-5.46

In hyperopic patients, number of amblyopic patients increased with degree of anisometropia. Approximately 58% (n=7) mild amblyopic patients had anisometropia greater than 2D spherical equivalent and 75% (n=6) moderately amblyopic patients had anisometropia greater than 2D spherical equivalent. There were no patients with severe amblyopia in hyperopia. There was no significant gender difference(p=0.45) and no significant difference of age groups(p=0.54) seen in distribution of depth of amblyopia with degree of anisohypermetropia. In myopic patients, number of amblyopic patients increased with degree of anisometropia. Among mild amblyopic patients, two patients had anisometropia between 3D-6D. In moderately amblyopic, two patients had anisometropia more than 6D. Both these patients with >6D myopia had bilateral moderate amblyopia. There was one patient with severe unilateral amblyopia with anisometropia > 6D. There was no significant gender difference(p=0.42) and no significant difference of age groups(p=0.54) seen in distribution of depth of amblyopia with degree of anisomyopia.

Table 5: Distribution of depth of amblyopia according to degree of anisometropia in patients with hyperopia

Depth of amblyopia	Degree of anisometropia			95% Confidence Interval
	1D	1.1D- 2D	>2D	
Mild	2	3	7	2.87-4.13
Moderate	0	2	6	1.67-2.56
Severe	0	0	0	2.31-4.67

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Table 6: Distribution of depth of amblyopia according to degree of anisometropia in patients with myopia

Depth of amblyopia	Degree of anisometropia			95% Confidence interval
	≤-3D	3D -6D	≥-6D	
Mild	0	2	0	7.61-4.15
Moderate	0	1	2	5.76-7.65
Severe	0	0	1	3.23-4.53

DISCUSSION

Prevalence of uncorrected refractive error, especially myopia was significantly higher in our study. In our study prevalence of uncorrected refractive error was 28%. In study conducted by Padhye et al [7]in 2009 prevalence was found to be 5.46% in urban population. In study by Hashemi et al. in rural areas of Iran, prevalence was found to be 18.94%. In study conducted Bhutia KL et al.[8]in school going children in east Sikkim, prevalence was found to be 6.7%. Overall prevalence of refractive error varies from 5.6% in Kamath et al study, 6.43% in study done by Niroula et al[9], 6.94% in Singh et al [10] ,7.57% Roopa naik et al[11], 11.9% prevalence in cross sectional study done by Shrestha et al[12], 22% in Gupta et al[13] .Compared to other studies reason for such high prevalence of uncorrected refractive error in our study was because , all children's were initially screened in school by their teacher for any complain of any defective vision and using vision chart available in school , as part of school health programme they were then referred to GTSH eye hospital, Rajkot for further evaluation and management. All studies have shown that considerable percentage of vision impairment is related to uncorrected refractive errors.

The most common refractive error in our study was astigmatism (73.5%) followed by myopia (15%) and hyperopia (11.2%). In contrast other studies like Mutti et al observed that among the eighth-grade children, the prevalence of myopia was 18.3% and hyperopia was 7.7% In Niroula et al[9] study, prevalence of myopia was 4.05%, hyperopia (1.24%) and astigmatism (1.14%). In a meta-analysis done by Castagno et al[14] prevalence of hyperopia was 2- 3% between age 9 and 14. In studies using the 5-15 age group and ≥ +2.00 D (RESC) cut-off, hyperopia prevalence ranged from 2.1% to 19.3%. and prevalence of astigmatism was only 1.23%.

Prevalance of astigmatism was very high in our study in comparison to other studies done.This high percentage can be attributed to different environmental factors in our state. These differences in astigmatism prevalence rate may be due to the differences in the characteristics of participating students (age, refractive error, etc.) and the method of measuring cylinder power. We believe this high prevalence rate of astigmatism in our study may be due to the high prevalence rate of myopia (15% with spherical equivalent of − 0.5 D or worse) in our study population. It was consistent with study done by Wang J et al.[15]

In different Asian and Indian studies percentage of prevalence varied from 13 per cent to 30% or higher depending on the age or ethnic groups.

In our study there is no significant difference of astigmatism between boys and girls (p value=0.67)). The WTR astigmatism is more than the ATR astigmatism. With advancing age WTR astigmatism showed the increasing trend and it was consistent with other studies.[16,17,18] In our study the trend and pattern of astigmatism in different age groups present results which are comparative with the other Indian and Asian studies.[19.]

Prevalance of amblyopia in our study came around **8% to 8.8%.** In the urban population, the study reported the prevalence rate of amblyopia to be about 4.4% (GV Murthy et al [20].). In a study done in Andhra Pradesh in India, the prevalence of amblyopia was 6.6% (K Anjaneyulu et al.[21]). Lack of adequate understanding or knowledge about this preventable and easily treatable condition, provided compliant treatment is started early, is often the reason why very few patients are referred to eye hospitals or specialist practices for the amelioration of the same especially in a developing country like India.

Higher prevalence of amblyopia in our study compared to other studies conducted in India was because highly intensified school health programme and vigilant screening at schools resulting in higher detection of the amblyopia in early stage.

In our study, we found gender preference, where the male amblyopia was 68.18% and female was 31.81% but the p-value was insignificant (p > 0.49). Similar finding was found in study done in Nepal which is demographically very similar to our study region (K Sapkota et al. [22],). An explanation for this gender discrepancy may be due to the bias that fewer girls report, as compared to boys in our hospital-based setting. Same gender preference was found in a study done by Lee et al[23]. But the opposite was found in study done by K Anjaneyulu et al., and Park et al.[24]

In our study, Combined Anisometropic with strabismic amblyopia (36.6%) was most common type of amblyopia seen.A Nepalese study showed similar findings where amblyopia due to combined anisometropia and strabismus was most common (59.2%) followed by strabismic ambyopia (33.5%). Our study was also consistent with recent Chinese study done by Xiao et al.[28], where Anisometropia was found in 92% of amblyopic eyes.

However, in study conducted by K Sapkota et al., K Anjaneyulu et al, and Park et al, strabismic amblyopia was most common type of amblyopia.

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In our study, Prevalence of refractory amblyopia was higher among the hypermetropic patients (76.66%) (95% CI- 3.11-5.14) in comparison to myopic patients (23.34%) (95% CI-2.12-4.78). In Indian study done by Menon et al., amblyopia due to hypermetropia was highest (51.65%). Similar results were seen in study by K Sapkota et al (33.6%), Sadia Sethi et al (60%) and Jing fu et al. (38.9%).

In our study, we found depth and prevalence of amblyopia increased as the degree of anisometropia increased and it was found to be statistically significant (p=0.045). It was similar to study by Dolezal ova [25] where refractory difference higher than 1D, had direct relationship with levels of anisometropia and depth of amblyopia was particularly marked when difference was higher than 2D. In study by Latval et al [26]., spherical equivalent of refractory error of 3.5D or more, or anisometropia of 1D or more were risk factors for developing amblyopia. Rutstein and Corliss [27]concluded that as degree of anisometropia increased, depth of amblyopia became greater. Rutstein and colleagues found that the depth of amblyopia increased along with increase in hypermetropic anisometropia.

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