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Study of Amblyopia in School Going Children during School Health Programme

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Abstract: ***Amblyopia as defined is a growing socioeconomic problem. It is difficult to assess the frequency of amblyopia in the general population. In this young population, amblyopia had caused severe unilateral impairment of vision 10 times more frequently than all other diseases and trauma. Increased attention paid in recent years by the media and medical community to early detection of strabismus has decreased the prevalence of amblyopia. Psychosocial difficulties related to amblyopia affect an individual's self-image, work, school and friendships. So early detection and treatment of amblyopia remains ideal goals to strive for, as documented by this study and other population based studies***

Keywords: Amblyopia, Strabismus

1. Introduction

One of the most dramatic sensory anomalies common in strabismus is the low visual acuity in one of the eyes, known by the term amblyopia.

This term literally means "dullness of the vision" (G. ambly dull, + ops, vision, sight). 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.

Albercht von graefe has defined amblyopia as a condition in which the observer sees nothing and the patient very little.

Prevalence, Social and Psychosocial Factors
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. From this one can reasonably assume 2.0% to 2.5% of general population has amblyopia.

Sachswenger stated that during the first 45 years of life amblyopia is responsible for the loss of vision in more people than ocular disease and trauma put together. In this young population, amblyopia had caused severe unilateral impairment of vision 10 times more frequently than all other diseases and trauma.

Vereecken and Brabant reported on the basis of their experiences and a questionnaire sent to 140 ophthalmologists that an improvement of visual acuity in the amblyopic eye after loss of the sound eye occurred only in 28.5% of 203 cases, either spontaneously (17.4%) or after pleotropic treatment (11.1%).

Increased attention paid in recent years by the media and medical community to early detection of strabismus has decreased the prevalence of amblyopia. So early detection and treatment of amblyopia remains ideal goals to strive for, as documented by this and other population-based studies. Certain conditions that are associated with amblyopia such as primary microstrabismus, heredity, failure to emmetropize, and high hypermetropia at age of 1 year cannot be prevented.

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. We are convinced that once a timely diagnosis of amblyopia is made, it is a professional as well as ethical duty of practitioner to institute treatment.

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.

Classification and Terminology

1) **Strabismic Amblyopia:** Mostly due to abnormal binocular interaction and is far more common in esotropes than in exotropes due to nasotemporal asymmetry of retinocortical projections. It is always unilateral.
2) **Anisometropic Amblyopia:** Mostly due to both abnormal binocular interaction and foveal pattern vision deprivation. More common and usually of higher degree in patient with anisometropia than in those with anisomyopia.
3) **Amblyopia Ex Anopsia (Visual Deprivation Amblyopia):** It could be unilateral or bilateral. Unilateral forms are more severe and usually associated with secondary esotropia or exotropia. It is mostly due to traumatic cataract or surgical lid closure and involves both abnormal binocular interaction and foveal pattern vision deprivation. Bilateral form is mostly due to

congenital cataract, corneal opacities etc. and involves foveal pattern vision deprivation.

4) **Meridional Amblyopia:** Selective visual deprivation of visual stimuli of a spatial orientation is caused by uncorrected astigmatism.
5) **Idiopathic Amblyopia:** It is a unilateral form of amblyopia observed in absence of any amblyopiogenic conditions. It may be due to clinically significant astigmatism or anisometropia in infancy which may disappear with advancing age.
6) **Amblyopia Secondary to Nystagmus:** Nystagmus may account for reduced visual acuity in its latent and manifest forms; however, one cannot always easily determine whether nystagmus is the cause or effect of reduced vision. In differential diagnosis of bilateral amblyopia, it is helpful to observe the fixation behavior in each eye during examination with the visuoscope or a conventional direct ophthalmoscope containing the fixation target in one of the interchangeable discs. When micro nystagmus is present, horizontal to-and fro oscillations of the eyes can be observed.

Aim of the study

Study of amblyopia in school going children during school health programme.

Objectives of the study

1) To study the prevalence of amblyopia in school going children in different age group.
2) To study the different types and severity of amblyopia in school going children.
3) To study the association between amblyopia and its causative factor.
4) To study the prevalence of monocular and binocular amblyopia in school going children.

2. Materials and Methods

This is a cross sectional hospital based study carried on 500 school going children upto 12th standard, selected by non-probability convenient sampling. The clinical profile of these children will be evaluated in department of ophthalmology, P. D. U Govt. medical college, Rajkot and will undergo detail assessment during period of November 2019 to February 2021 under school health programme.

Inclusion Criteria: A patient who is referred under school health programme coming to OPD of GT SHETH Eye hospital, PDU Medical College, Rajkot is included in the study.

Exclusion Criteria: Patients with any other ocular pathology are excluded from the study.

2.1 Methods

1) Number of cases:-500
2) School going children upto 12th class.
3) Valid informed written consent will be obtained from the patient.
4) Patient to be chosen according to inclusion and exclusion criteria.
5) Detailed history will be recorded.
6) Study will include following investigations
- Visual acuity
- Slit lamp examination
- Cycloplegic refraction
- Fundus examination.
- Squint examination, if required

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

1) Patient's 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 to age of onset as noticed by the patient or his guardians, age of presentation to the hospital, 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) Patients visual acuity and best corrected visual acuity were recorded with each eye separately, using well illuminated snellen's visual acuity chart with patient sitting at distance of 6 meters.
7) Refraction under appropriate cycloplegics depending upon age of the patient, assessment of ocular alignment, ocular motility, and associate deviations if any.
8) Squint examination with cover test and also angle of deviation, assessment of the binocular status of the eye was performed whenever possible with help of worth's four dot test.
9) Patients anterior segment examination was done with help of slit lamp bio microscopy to rule out anterior segment pathology.
10) A detailed fundus examination was done to rule out any posterior segment pathology and to determine the fixation pattern.

3. Result and Analysis

Amblyopia is one of the most common causes of visual impairment in children with prevalence varying between **8% and 8.8% in our study**.

The population based regional studies in India related to the childhood blindness and prevalence of refractory errors showed prevalence rate of amblyopia to be 1.1% (V Kalikiyavi et al.,). In another study by Rahi et al., involving nine states in our country, cataract, uncorrected aphakia and amblyopia comprised of 12.3% severe visual impairment. In the urban population, the study reported the prevalence rate of amblyopia to be about 4.4% (GV Murthy et al.,). In a study done in Andhra Pradesh in India, the prevalence of amblyopia was 6.6% (K Anjaneyulu et al.,). 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.

Table 1

Type	Fixation Pattern		Total
	Central	Eccentric	
Anisometropic	05	05	10
Strabismic	08	05	13
Combined	12	04	16
Meridonial	04	00	04
Sensory Deprivation	01	00	01

In contrast, In South-Asian region the Chinese studies showed prevalence rate which varies between 0.8% to 2.5% in different subsets of population done by (Andrey Chia et al., and Jing Fu et al.,) respectively. In a Nepalese hospital-based study the prevalence was 1% [20]. Another hospital-based study done in Bharatpur, Nepal, the prevalence rate was 1.40% (Gopal Bhandari et al.,) It may be due to high literacy rate in the urban population, higher paediatric referrals from peripheral health centres and from visual screening programmes in schools.

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 ($p > 0.05$). Similar finding was found in study done in Nepal which is demographically very similar to our study region (K Sapkota et al.,). 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. But the opposite was found in study done by K Anjaneyulu et al., and Park et al.

In our study, Hypermetropia was the most common refractive error (59.1%) in amblyopic eyes followed by Myopia (34.1%).com**bined Anisometropic with strabismic amblyopia (36.36%) is most common in our study and sensory deprivation amblyopia was least common (2.27%).** 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., where Anisometropia was found in 92%of amblyopic eyes.

Table 2

Type	Number of Patients	Percentage (%)
Anisometropic	10	22.73%
Strabismic	13	29.55%
Combined	16	36.36%
Meridonial	04	9.1%
Sensory Deprivation	01	2.27%

In Indian study done by Menon et al., amblyopia due to hypermetropia was highest (51.65%). Anisometropia amblyopia was second most common (22.1%) after strabismus amblyopia (37.38%), followed by ametropic amblyopia 12.88%, and meridional amblyopia was 5.56%.
Even if anisometropia is optically corrected, aniseikonia may be another amblyogenic factor for development of amblyopia. Severity and prevalence of amblyopia increases as the amount of anisometropia increases. Hypermetropic patients with anisometropia of one Diopter difference may have amblyopia, while myopic anisometropic usually do not have amblyopia until anisometropia is large. Unilateral high hyperopia or myopia greater than 6 Diopter can cause severe amblyopia. Isometric amblyopia (severe symmetric refractory errors) may cause mild to moderate bilateral amblyopia, more common in hyperopes (in excess of +6 Diopter) than in myopes. This is because sharply focused images of objects held closely support the normal visual development in myopia. In meridional amblyopia the mild degree of astigmatism greater than 1.5 Diopter can be amblyogenic.

Table 3

Refractive Status	Number of Patients	Percentage (%)
Hypermetropia	26	59.1%
Myopia	15	34.1%
No Refractive Error	03	6.8%

Another important factor that this study reveals is the relatively older ages of presentation to a speciality clinic irrespective of the sub-type of amblyopia present. Seven to 8 years is the critical time after which therapeutic measures for the treatment of amblyopia become less effective

Table 4

Type	Visual Acuity			Total
	6/18-6/36	6/30-3/60	<3/60	
Anisometropic	03	07	00	10
Strabismic	11	02	00	13
Combined	11	04	01	16
Meridonial	01	03	00	04
Sensory Deprivation	01	00	00	01

In our study, the age of presentation of amblyopia in 8-10 years age group (avg.10.6 years) was more for male cases (81.25%) and less for female cases (25%). In the 10-15 years age group the female cases were more (75%). Our findings are consistent with a study by K Sapkota et al., where the male/female ratio was 44/20 for younger age group and 15/19 older age group. Anisometropia amblyopia is the most common cause of amblyopia in another study. The reason for development of amblyopia in anisometropia is a chronically blurred image in one or both eye prevents the normal development of visual acuity.

In study of Vimla menon, Zia Chaudhari, Rohit Saxena, Kulwant Gill, MM Sachdev the average age of amblyopia is 7.97± 6.18 years.

Table 4

Type	Average age of presentation in (years)
Anisometropic	9.3
Strabismic	10.4
Combined	10.3
Meridonial	12.8
Sensory Deprivation	11

Gopal Bhandari concluded that the average age is 6.79±2.54 year. Jing fu reported the average age is 7.1±0.4 year

2. Discussion

Amblyopia and associated strabismus can have devastating psychosocial and economic fall-outs. Failure to develop binocular vision and unilateral or bilateral visual impairment may prevent the individual from pursuing certain occupations. Severe amblyopia is also considered a significant risk factor for blindness in case an individual loses sight in the fellow eye.

Timely diagnosis and treatment is likely to reduce the prevalence of amblyopia as has been seen in many countries that have taken up mass education and visual screening as important community aids to increase knowledge and awareness about the condition.

There have been population-based regional studies in India related to childhood blindness and prevalence of refractive errors, where amblyopia has been noted to be one of the causes of visual impairment seen. A recent Indian study, elucidating a population-based perspective on childhood blindness stresses on amblyopia after cataract surgery to be a major cause of preventable childhood low vision. Similarly, another study by the same authors on planning low vision services in India, marks out amblyopia to be one of the main causes of paediatric low vision accounting for about 26% of the children with low vision examined. There have, however, been no studies where amblyopia has been the primary focus of attention with the establishment of the patient profile, age of presentation, and other demographic details.

Though the present study suffers from a selection bias, as the data is hospital based, this analysis may form the basis of future population-based studies. However, one advantage of a study in a hospital referral practice with a very wide base of patients coming from all parts of the country, is the immense variety and numbers that can be seen, which can be utilised to elucidate the clinical profile of that condition under as ideal a circumstance as possible.

This reiterates that efforts to screen patients for amblyopia and educate personnel at every level to suspect, diagnose, treat or refer the patient as soon as possible. This effort could be directed towards starting vision screening programmes in schools and mother and child care clinics and training village health workers to assess for visual acuity, ocular movements, and the fixation behaviour of the non-occluded eye after covering one eye in children presenting to them to a level adequate for them to recognise a problem and refer the patient as soon as possible. Paediatricians could be trained to look for delays in the development of visual milestones in children. They could also be trained to assess visual acuity in very small children with Cardiff or Teller's visual acuity charts. This would however call for easy availability of these expensive equipment's and a short training course for paediatricians. The aim of training in all these quarters would be to enhance early referrals at a younger age group, which is of utmost priority while treating a patient with amblyopia. Institution of measures like the health-related quality of life (QOL) questionnaires which have been performed for the evaluation of many paediatric conditions including amblyopia, in the Western countries, could be of immense value to trial developers, who can use all these parameters to design appropriate randomised studies, which could demarcate areas where further action needs to be taken in the community.

Early detection of amblyopia and institution of appropriate therapy is of immense value towards preventing the prevalence of lifelong visual morbidity. As mentioned earlier, we observed that the vast majority of patients with amblyopia in our study presented between 4 and 10 years of age. Associated strabismus was one of the reasons for early referral. Though patients with anisometropic amblyopia presented relatively later (when the child became verbal or when there was some other associated problems, the anisometropia being discovered as an incidental finding), these patients had better BCVA, higher prevalence of central fixation and higher grades of binocularity vis-à-vis patients diagnosed as having other subtypes of amblyopia especially those with form deprivation amblyopia (excluding meridional amblyopia). These findings are in agreement with other studies.

There are no other Indian studies which have prospectively evaluated the clinical profile of different sub-types of amblyopia, be it community based or hospital based. Knowledge about the sub-types of amblyopia is important because the clinical presentations, management and outcomes of these different types are different. Both in the context of Vision 2020, with the added stress on rehabilitation of paediatric low vision, of which amblyopia is a major preventable and treatable cause, and the fact that untreated amblyopia is a major cause of monocular or binocular low vision in adulthood, with the associated deterioration in the QOL indices, measures for the early detection and dedicated rehabilitation of amblyopia should be taken up on a priority basis and form another tenet of the evidence-based planning that has been the hallmark of the blindness control programme in India. 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. Providing appropriate training to these personnel and incorporating their services could aid early detection and rehabilitation of patients. An ophthalmic referral to ophthalmologists in preschool children by paediatricians for assessment of visual acuity and the fundus, could be a key for early detection of amblyopia.

It is important to remember that amblyopia is often a diagnosis of exclusion. Other causes of low vision need to be evaluated before diagnosing a patient as a case of amblyopia. In the present study, we found a high co-relation between the fixation pattern of the eye and the BCVA with increased centricity of the fixation pattern indicating better visual acuity. We recommend that evaluation of the fixation pattern, which is possible with the standard direct ophthalmoscope present with every ophthalmologist, should be an essential part of an ophthalmic examination in a child.

This would be of great importance in preverbal children, in uncooperative children and mentally challenged children in the absence of the more expensive modalities of assessing paediatric visual acuity.

The present study was a cross sectional study defining the pattern and profile of patients with amblyopia referred under school health programme to eye department in PDU government medical college, Rajkot. Follow-up measures and response to treatment instituted in these patients after starting therapy is outside the preview of this report.

However, it is important to stress that regular follow-up (after 2-3 weeks in children less than 3 years and after 4-6 weeks in older children and adults) is of utmost importance to monitor both the compliance to therapy and the response to treatment. Population-based studies at a future date would be useful to further validate the mass education measures that can be taken up to prevent and treat this condition.

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