



Study of Refractive Errors, Amblyopia and Compliance of Spectacles in School Children

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ABSTRACT

Objective: 1. To estimate the prevalence of refractive errors in school children (6-17yrs) and to categorize them. 2.To find out the prevalence of amblyopia in school children. 3.To study the compliance of spectacle use in children and to analyse factors determining the compliance of spectacle use in them.

Study Design: Prospective study conducted in 1.DV lower primary school, Mundathikode, Thrissur. 2. NSS higher secondary school Mundathikode, Thrissur. 3. Department of ophthalmology, Government medical college, Thrissur

Duration of study: 1 year

The study was conducted in four phases. 1. Vision screening of all children done in the schools. 2. Detailed evaluation of those children with a visual acuity $\leq 6/9$ or asthenopic symptoms for ocular alignment. 3. Post-mydratic test for subjective refraction and prescription of glasses in suitable cases. 4. Follow up 6 months after prescribing spectacles by a surprise school visit to assess the compliance of spectacle use, which is followed by a re-evaluation of vision in the Medical College Hospital.

Results: A total of 1183 students were screened using the Snellen's visual acuity diagram. 82 students were detected to have refractive errors. Prevalence of refractive errors in this study was 6.9%. The prevalence of myopia was 2.28%, hypermetropia-0.17% and astigmatism- 4.48%. The prevalence of amblyopia among the total number of students screened was 0.33%. among students with refractive errors it was 4.9%.

Conclusion: Refractive error in children is under diagnosed and proper awareness can prevent amblyopia in them by increasing compliance

Keywords: Refractive error, Myopia, astigmatism, Hypermetropia, amblyopia, Spectacle compliance

Introduction

Vision is perhaps the most precious possession among the five senses and even a mild deterioration in vision is a reason for concern for an individual. Adequate care and preservation of eyesight should be the foremost concern of every human being. If we analyze the causes of preventable blindness, refractive errors come second, topped only by cataract. Refractive error is an optical defect

intrinsic to the eye, which prevents the light from being brought to a single point focus on the retina thus reducing normal vision. These are the commonest cause of visual impairment around the world and the second leading cause of treatable blindness. Refractive errors are common in children. But unfortunately in most of the children refractive errors remain undiagnosed and untreated due to various reasons.^[1,2,3,4,5]

In India, there is a large proportion of school going children. Defective vision in children poses many problems. Most children, unlike adults do not complain of defective vision. Sometimes the parents are not taking the child's complaints seriously. It is difficult to objectively quantify the vision in pre school children. Defective vision can have a serious impact in a child's future career. It affects the child's academic performance. If not detected early and corrected properly it can lead to amblyopia and permanent visual disability. All these factors point towards the need for routine screening of vision in children. It can be done in schools for all children irrespective of their symptoms. It can be done by regular school visits by health personnel or by trained teachers.

Another problem is correction of refractive errors by spectacles. Compliance of spectacles in children is not as good as in adults. The factors responsible for this lack of compliance are many. It requires a lot of effort from the part of health professionals, parents and teachers to ensure continuous wearing of spectacles in children. There are only few studies regarding the compliance of spectacle wearing in children. Analyzing these factors is important to ensure better compliance and to achieve optimal vision.^[6,7,8,9,10]

Symptoms of refractive errors vary, particularly in children who can accommodate to a large extent. The usual symptoms are blurring of vision, headache, watering, recurrent sty, strabismus etc. This study was an attempt to analyze the magnitude of refractive errors and amblyopia in school children and to find out the relative proportion of different types of refractive errors. The second part of the study was to assess the compliance of spectacles in school children and to analyze the various factors, which have impact in spectacle wearing.

Objective of the study

1. To estimate the prevalence of refractive errors in school children (6-17yrs) and to categorize them.

2. To find out the prevalence of amblyopia in school children.
3. To study the compliance of spectacle use in children and to analyse factors determining the compliance of spectacle use in them.

Study design: Prospective study

Study Place: 1.DV lower primary school, Mundathikode, Thrissur.2. NSS higher secondary school Mundathikode, Thrissur.3. Department of ophthalmology, Government medical college, Thrissur

Duration of study: 1 year

Study period: September 2009 to August 2010

All students in DV lower primary School and NSS higher secondary school Mundathikode, Thrissur from class 1 to +2.

An approval for the study was obtained from the institutional ethics committee.

The study was conducted in four phases.

1. Vision screening of all children in DV lower primary School and NSS higher secondary school, Mundathikode, Thrissur from class 1 to +2 using a Snellen distant vision diagram. This was done in the schools.
2. Detailed evaluation of those children with a visual acuity $\leq 6/9$ or asthenopic symptoms for ocular alignment, slit lamp examination, autorefractometry, retinoscopy and fundus examination in the Department of Ophthalmology, Government medical college, Thrissur
3. Post-mydratic test for subjective refraction and prescription of glasses in suitable cases.
4. Follow up 6 months after prescribing spectacles by a surprise school visit to assess the compliance of spectacle use, which is followed by a re-evaluation of vision in the Medical College Hospital.

Phase 1 - Vision screening

Visual acuity of every student was checked with a Snellen's distant vision diagram. Screening was first done in DV LPS and then in the NSS HSS. Some children in class 1 had difficulty in identifying letters due to the learning curve for whom a picture diagram comprising of familiar pictures were used. Vision was checked in a classroom with adequate light. The Snellen's

diagram was placed in the wall and every child was made to stand 6 meters from the diagram. Vision of both eyes recorded separately. Visual acuity of about 100 students was done in a single day. A list of children who has a visual acuity of $\leq 6/9$ or who has symptoms presumably due to refractive error was made. Head mistress of the school was entrusted to inform the parents of children with diminished vision and to bring their children to the Department of Ophthalmology, Government medical college, Thrissur for detailed evaluation in the prefixed date. 8 children were called to the hospital in a single day so as not to disturb the routine functioning of the outpatient department.

A total of 1183 students were screened which included 558 boys and 625 girls. 110 students had a visual acuity $\leq 6/9$ in at least one eye.

Phase 2 - Detailed evaluation

The nature of the study and its relevance were well explained to the parents. A well informed consent form was obtained from the parents. The information from every student was recorded in proforma.

The proforma contained basic information about the student, his ocular symptoms, and its duration, past history of ocular illness including refractive error, relevant family history and socioeconomic data. The examination findings including ocular alignment, relevant slit lamp findings, vision,

Autorefractometry, retinoscopy and fundus examinations were also included in this proforma.

The examination started with testing the ocular alignment to find out presence of squint. It included the Hirschberg test, cover test and cover - uncover test. Examination of the lids, conjunctiva and cornea were carried out under diffuse illumination and were confirmed by slit lamp examination. Pupillary reactions were noted.

Visual acuity was rechecked with a Snellen's illuminated vision box. Of the 110 children who came to the hospital, 28 had an acuity $>6/9$ when acuity was checked with a Snellen's illuminated vision box. These children were exempted from the study. So the number of students with visual acuity

$\leq 6/9$ were scaled down to 82. These 82 children underwent retinoscopy.

Pupil was dilated with homatropine. Retinoscopy and autorefractometry were carried out about 90 minutes after instilling homatropine. A detailed fundus examination was also carried out.

Children and their parents were informed about blurring of near vision for few hours. They were also instructed to bring their children for post mydriatic test after one week

Phase 3: Post mydriatic test was carried out to find out the refractive error as follows.

Amount of refractive error = retinoscopic findings - deduction for distance- tonus allowance for the cycloplegic used

Since the refraction was done at a distance of 1 metre and homatropine was used for cycloplegia, the above formula was modified as,

Amount of refractive error = Retinoscopic findings - 1 - 0.5

After finding out the spherical and cylindrical powers, subjective refraction was carried out and the appropriate axis was find out.

Refinement of spherical, cylindrical power and axis were done with the help of Jackson's cross cylinder and finalized with Snellen's visual acuity box.

A properly written and signed spectacle prescription was given to the parent. They were explained the importance of constant wearing of spectacles. They were warned about the possible non-compliance by children. They were instructed to allow their children to select spectacle frame, which may enhance the compliance. They were also instructed to select the spectacle of appropriate size, so that it will not slip down or cause discomfort on prolonged use. They were told to report to the hospital if any undesired effect with spectacle use arises.

The findings in these visits were recorded in the proforma II.

Children who had an interocular difference of 2 lines or more in the best corrected visual acuity or whose corrected vision was $< 6/12$ in both eyes was diagnosed to have amblyopia. These children were advised follow up every 4 weeks and continuous wearing of glasses.

Phase 4 – Follow up

6 months after the prescription were given; a surprise school visit was carried out to know whether the children use the spectacles constantly. A review in the hospital was deliberately avoided because most of the children may wear the spectacles even if they don't do so routinely to avoid scolding and may hinder the compliance.

Students whom spectacles were prescribed were located in their respective classes and status of their spectacle use was noted.

Students were asked about their status of spectacle use and the causes if they didn't use it constantly.

All these students irrespective of the status of their spectacle use were asked to report to the outpatient department in the following days again in a group of 8 students in a single day. In the hospital their current uncorrected vision and best corrected vision either with their present spectacles or trial glasses were checked.

Results

A total of 1183 students were screened using the Snellen's visual acuity diagram. 82 students were detected to have refractive errors. Prevalence of refractive errors in this study was 6.9 %. The prevalence of myopia was 2.28%, hypermetropia- 0.17% and astigmatism- 4.48%. Among the 1183 students screened, 558 were boys and 625 were girls. 37 boys and 45 girls were detected to have refractive errors. Prevalence among boys was 6.63 % and among girls was 7.2 %. (Table 1)

In the age group of 6-11 yrs, 462 students were examined and 32 were found to have refractive errors with a prevalence of 6.93 % (Table 2)

In the age group of 12-17 yrs, 721 students were screened and 50 students with refractive errors were detected with a prevalence of 6.93 %.

Among different types of refractive errors, myopia was seen in 27 students, i.e. 32.9 % of total refractive errors. 37 students had simple myopic astigmatism and 10 had compound myopic astigmatism, with a relative proportion of 45.1 % and 12.2 % respectively. Other types of refractive errors were very few in number. Hypermetropia was

seen in only 2 students (2.4%), simple hypermetropic astigmatism in 3 (3.7%), compound hypermetropic astigmatism in 2 (2.4%) and mixed astigmatism in 1(1.2 %) student. No case of pathological myopia was found in this study. (Table 3)

Among boys, 13 (35.1%) had simple myopia, 13 (35.1%) had simple myopic astigmatism, 7 (18.9) had compound myopic astigmatism, 2 (5.4%) had simple hypermetropic astigmatism, 1 (2.7 %) each had compound hypermetropic astigmatism and mixed astigmatism. No cases of hypermetropia was detected in boys

Among girls simple myopia was found in 14 (31.1%), simple myopic astigmatism in 24 (53.3%), compound myopic astigmatism in 3 (6.7 %), hypermetropia in 2 (4.4 %). 1 student each (2.2 %) had simple hypermetropic and compound hypermetropic astigmatism.

Regarding symptomatology, blurring of vision was the most frequent symptom followed by eyestrain, headache and watering.

45 students complained of blurring of vision i.e. 54.9 % of the total students with refractive errors. 29 student had eye strain (35.4 %). 28 students(34.1 %) had complaints of recurrent head ache. 28 students had watering. 9 students (11 %) had history of recurrent stye. 5 students had co existing squint. 5 students did not have any symptom despite the refractive error

In case of myopia, blurring of vision was the commonest symptom. Of the 27 students with myopia, 20 had history of blurring of vision. Headache was present in 9 students. 2 students each had watering and recurrent stye. 1 student had squint and another one had complaints of eyestrain

In the case of myopic astigmatism, eyestrain and watering were the common symptoms. 24 students (20 with simple myopic astigmatism and 4 with compound myopic astigmatism) had eyestrain. 23 students (20 with simple myopic astigmatism and 3 with compound myopic astigmatism) had watering as their chief complaint. Blurring of vision was complained by 14 students with simple myopic

astigmatism and 7 with compound myopic astigmatism.

Both students with hypermetropia had complaints of head ache. 1 student had complaints of blurring of vision, 1 had eyestrain.

Regarding duration of symptoms, 29 children were symptomatic for more than 1 year. 27 students had symptoms for more than 6 months, but less than 1 year. 26 students had symptoms for less than 6 months

24 students had previous history of refractive errors. This accounted for 29.3% of the total number of children with refractive errors. 20 students had used spectacles to correct their refractive errors. 10 of them discontinued spectacles. 10 were using them either constantly or intermittently

28 students had a family history of refractive errors in their first-degree relatives. 6 had a family history of squint.

Family history of refractive errors was most frequent in the case of myopia. 15 of 27 students with myopia had a first-degree relative with refractive error; 11 students with myopic astigmatism also had family history of refractive errors.

On examination, 4 students had strabismic amblyopia. 2 students had exotropia, 3 had esotropia and 8 had exophoria.

Amblyopia, as defined by an interocular difference of at least 2 lines in the best corrected visual acuity or a best corrected visual acuity of less than 20/40 in both eyes, was detected in 4 students. Three cases were unilateral and one case was bilateral. Of these one was Strabismic amblyopia and three were anisometropic amblyopia. Of the four cases of amblyopia three were girls and one was a boy. {9,10,11,12,13,14,15}

The prevalence of amblyopia among the total number of students screened was 0.33 %. Among students with refractive errors it was 4.9 %

All the four children with amblyopia belonged to the 6 - 11 yrs age group (Table 4).

These four children were followed up every 4 weeks. All the three cases of anisometropic amblyopia showed improvement in best-corrected visual acuity with spectacles alone. Two children on the third follow up visit showed improvement in visual

acuity, which improved further in the subsequent follow up visits. One child showed improvement of visual acuity in the fourth follow up visit with further improvement with spectacles alone. As these children showed progressive improvement in visual acuity, they were not advised I occlusion therapy or penalization.

The only child with strabismic amblyopia showed a very poor compliance. They did not come for any review. Attempts to contact her in the school also failed due to poor attendance in school. In the last follow up, her vision and strabismus remained the same.

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Compliance of spectacles ^[16,17,18,19,20,21]

Of the 82 students who were prescribed glasses, 52 (63.4%) were using them constantly, 21 (26.6%) were using them intermittently and 9 (11%) students were not using them at all (Pie diagram 1)

There is a slightly better compliance among girls compared to boys

In the case of boys, 22 (59.5%) were using the spectacles constantly, 10 (27.5%) students were intermittent users and 5 were not using the spectacles.

In the case of girls, 30 (66.7 %) were constant users, 11 were intermittent users and 4 were not using them.

There was no significant difference in compliance between the younger age group (6-11 yrs) and the older age group (12-17 yrs).

In the age group of 6-11 yrs, 20 (62.5 %) students were using the spectacles constantly, 8 (25 %) were intermittently using the spectacles and 4 (12.5%) were not using the spectacles.

In the age group of 12-17yrs, 32 (64 %) were constant users, 13 (26%) were intermittent users and 5(10 %) were not using the spectacles.

There was a significant association between compliance of spectacles and socio-economic status. Among children belonging to middle socio economic strata, 69.1% were using the spectacles constantly whereas only 51.9 % children from the lower socioeconomic group were using them constantly.

Causes of non compliance ^[22,23,24,25]

In the case of intermittent users, 5 students thought spectacles needed only at the time of reading or writing, which in fact were prescribed for both the distant and near vision.

5 students were concerned about their appearance with spectacles, so using the spectacles at their homes only. 5 students were afraid of being teased

by their classmates, so were not using the spectacles in school hours. 4 students experienced discomfort with their spectacles in the form of pain in the temple, headache. In the case of 5 students, there was no particular cause for not using the spectacles constantly (table 5)

Of the 11 girls who were intermittent users, 5 were concerned about their appearance with spectacles and 3 were afraid of being teased by their classmates. 3 of them thought spectacles are needed for close distance activities. 2 girls were not comfortable with their spectacles and one girl had no specific reason

In the case of boys, four had no particular reason for not using the spectacles. Two students were using them only in the school hours; two had discomfort on wearing their spectacles. Two students forgot their glasses at home. One boy was using the glasses only at home to escape from teasing by class mates.

Nine students were not using the spectacles. Of these nine students, five had not bought the spectacles. Three of them could not afford the cost of the spectacles. Parents of two children were not convinced about the use of spectacles, so did not buy them

Four students discontinued the spectacles. Of these three were boys, spectacles of all of them were broken and new ones were not bought. The other one was a girl who stopped wearing the spectacles because of teasing by her friends.

Table 1 Prevalence of refractive error

Refractive error	Boys		Girls		Total	
	N	%	N	Percent	N	%
Yes	37	6.6	45	7.2	82	6.9
No	521	93.4	580	92.8	1101	93.1
Total	558	100	625	100	1183	100

Table 2 Prevalence of refractive error

Refractive error	6-11 years		12-17 years	
	N	%	N	%
Yes	32	6.9	50	6.9
No	430	93.1	671	93.1
Total	462	100	721	100

Table 3. Proportion of type of refractive error

Errors	N	%
Simple myopia	27	32.9
Simple myopic astigmatism	37	45.1
Compound myopic astigmatism	10	12.2
Hypermetropia	2	2.4
Simple hypermetropic astigmatism	3	3.7
Compound hypermetropic astigmatism	2	2.4
Mixed astigmatism	1	1.2
Total	82	100

Table 4: Prevalence of Amblyopia

Amblyopia	6-11 years		12-17 years	
	N	%	N	%
Yes	4	12.5	0	0
No	29	87.5	50	100
Total	32	100	50	100

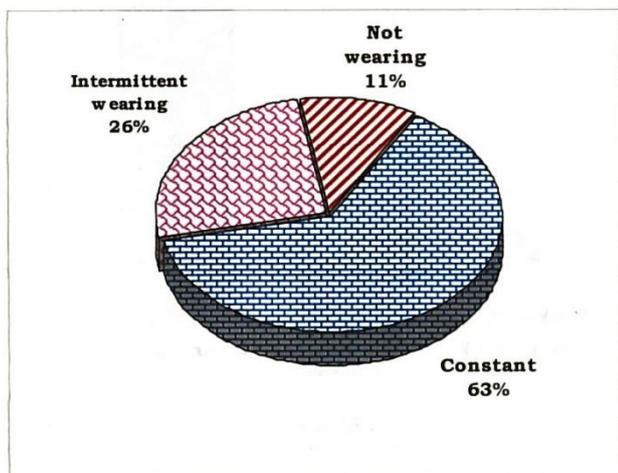


Diagram 1 Compliance of spectacle use

Table 5 Cause of intermittent wearing of spectacles

Causes	Frequency	Percent
Thought spectacles needed only for reading or at special times	5	23.8
Forget to wear glasses	2	9.5
Spectacles causes discomfort	4	19.0
Cosmetic concern	5	23.8
Teased by class mates	5	23.8
No specific reason	5	23.8

Conclusion

Prevalence of refractive error is very common in school children and timely and early detection will definitely help to prevent amblyopia

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