Original Article

Factors associated with spectacle-wear compliance among school children of 7-15 years in South India

Abstract

Background: Easily correctable refractive errors are the commonest cause of visual impairment in school children in India. Children who need but cannot afford spectacle correction are high in our country. Important factor for the success of the corrective services is compliance to spectacle wear. **Objective:** To assess the spectacle wear compliance among school children who were provided spectacle free of cost. To study the determinants of spectacle acceptance and reasons for non compliance. **Materials and Methods:** All (1378) government school children of 7-15 years age group in both rural and urban field practice areas of a medical college in Bangalore were screened and students with refractive error were provided spectacles free of cost. An unannounced follow up was done after 3 months to assess compliance. Data was analyzed to determine the factors associated with spectacle wear compliance. **Results:** Among 36 boys and 47 girls who received spectacles free of cost, 31 were from rural and 52 from urban schools. 48(57.8%) children were actually wearing the spectacles at the time of follow up. 42(87.5%) compliant children reported improvement of performance in school related activities. Compliance was better in younger children and those from urban schools. Children of father with lower level of education and with power -0.5D were more likely to be non compliant. **Conclusion:** To achieve the goal of vision 2020 timely detection of refractive errors should be followed by cost effective intervention. The barriers to spectacle acceptance should be studied and addressed.

Key words: Eye glasses, refractive errors, spectacle acceptance

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INTRODUCTION

The World Health Organization's "Vision 2020: The Right to Sight" initiative's one of the main priorities is the correction of refractive error in developed and developing countries.[1] Uncorrected refractive errors are the most common cause of visual impairment in school children in most parts of the world including India,[2] which can be easily corrected by a simple pair of eyeglasses.

The proportion of children who could benefit from spectacle correction and do not yet own or wear glasses has been found to be high in many studies conducted in Mexico,[3] Tanzania,[4] suburban Chile[5] and China.[6,7] However no such data is available for India and also little published research has focused on barriers to spectacle use in this age group in India.

Provision of spectacles and compliance currently poses a challenge in many developing countries due to issues related to availability and affordability. Different strategies are being tried out to provide low cost or free of cost spectacles but unless the compliance to spectacle-wear is good the efforts taken to provide corrective services will not be effective.

Our study has been under taken to look at spectacle-wear compliance among children who received spectacles free of cost in a school based program and the factors determining spectacle-wear. The study was also aimed at finding the possible reasons for non-compliance.

The goal of vision 2020 cannot be achieved only by timely detection of refractive errors unless efforts are taken to remove the barriers to spectacle availability and acceptance in this age group.

MATERIALS AND METHODS

A cross-sectional study was conducted in the government schools of urban and rural field practice areas of a Medical College in Bangalore, India to determine the prevalence of refractive error among the school children of 7-15 years age group. At the end of this school based study students with refractive error were provided corrective spectacles free of cost. During the study, 1378 children were screened for poor vision. Study subjects of this study were all the students who received corrective spectacles through the school based study.

Informed written consent of the Head Master of all the schools and assent of the children were obtained. The study protocol was approved by the ethical committee of the Medical College, Bangalore. The Declaration of Helsinki for research involving human beings was adhered to throughout the study.

The initial visual acuity screening was carried out using Snellen's Illiterate "E" chart in a well-illuminated class room chosen in each school. Visual acuity was measure for each eye separately at a distance of 6 m. Children with poor vision (acuity < 6/12) were listed and examined by the refractionist. Objective refraction was performed with a streak retinoscope. Using it a streak of light was projected into the pupil and a series of lenses were flashed in front of the eye. Based on the movement and orientation of this retinal reflection, the refractive state of the student's eye was measured. This was followed by subjective refraction with a trial frame and trial cases of lenses. Lenses and other settings were changed first to correct the spherical element of refractive error followed by determining astigmatic correction and finally balancing/modifying the refractive correction by asking feedback on which settings gives the best vision to ensure optimal visual performance and comfort. All hypermetropes and few others for whom best corrected visual acuity could not be achieved underwent cycloplegic refraction with tropicamide eye drops.

Children with myopia of more than or equal to –0.5 spherical equivalent diopters in one or both eyes, hypermetropia ≥ +1.00 spherical equivalent diopters in one or both eyes and astigmatism ≥1.00 D were provided with corrective spectacles at a later date free of cost.

Children and their class teachers were briefed about the importance of wearing spectacles regularly. Children were instructed to wear spectacle in the school and also at home when studying and watching television.

An unannounced follow-up visit to the schools to assess spectacle-wear compliance was conducted 3 months after the students received their spectacles. Direct inspection was done to see if the student was wearing spectacles. A standard interview was performed with the children and their class teachers to assess any improvement in the performance of the child in school related activities after correction of refractive error. Children not wearing spectacles were asked the reasons for not wearing. Other information including age, gender and place of residence were noted from previous records.

The data was entered in Microsoft Excel spreadsheet and analysis was carried out using the software Statistical Package for Social Scientists (SPSS 15.0). Logistic regression analysis was carried out to assess the factors influencing the compliance. Relevant odds ratio (OR) and respective 95% of confidence interval are presented. Chi-square and Fisher exact test was used to determine association between spectacle use and power of the eye. $P < 0.05$ was considered to be statistically significant. Results on continuous measurements are presented on mean ± standard deviation (Min-Max) and results on categorical measurements are presented in number (%).

RESULTS

Out of 1378 children who participated in the school based study 97 children were diagnosed with significant refractive error and all were provided with corrective spectacles free of cost. A total of 83 students, (85.6% of the original sample) out of 97 could be located and interviewed during the follow-up at the end of 3 months.

The study group comprised of 36 (43.4%) boys and 47 (56.6%) girls and 31 (37.3%) were from rural schools and 52 (62.7%) were from urban schools, 15 (18%), 20 (24%) and 48 (58%) of children belonged to the age group of 7-9 years,10-12 years and 13-15 years respectively. The mean age of the subjects was 12.19 ± 1.0 years.

The number of children with myopia were high 49 (59%) in this study group, 20 (24%) children had astigmatism and 14 (16.9%) children were diagnosed with hypermetropia.

After 3 months of providing spectacles free of cost, it was found that 48 (57.8%) children were actually wearing the spectacles at the time of an unannounced follow-up and 35 (42.2%) were not wearing the spectacles.

Among the children showing compliance to spectacle-wear, 42 (87.5%) of them reported improvement of performance in school related activities, which was confirmed by the teachers in 36 (85.7%) cases.

The distribution of socio-demographic factors according to the compliance is shown in Table 1.

Of the 48 children who wore spectacles, 30 (62.5%) had myopia, 8 (16.6%) had hypermetropia and 10 (20.8%) had astigmatism in at least one eye. Overall, 56.6% of children with myopia wore glasses, as did 72.7% with hypermetropia and 52.6% of children with astigmatism.

Compliance was better in the children who had power of –1 D and below in either of the eyes ($P = 0.001$). Children with –0.5 D or –0.75 D of power were more non-compliant ($P = 0.001$). Power of ≥ +0.5 D was not associated with compliance with spectacle-wear.

The reasons for non-compliance with spectacle-wear were as follows.

The socio-demographic data associated with spectacle-wear were gender, age, location and father's education [Table 2].

Table 1: Distribution of study population according to spectacle-wear compliance

Variables	Outcome	
	No compliance (%)	Compliance (%)
Age in years		
7-9 years	4 (11.4)	11 (22.9)
10-12 years	12 (34.3)	8 (16.7)
13-15 years	19 (54.3)	29 (60.4)
Gender		
Male	19 (54.3)	17 (35.4)
Female	16 (45.7)	31 (64.6)
Class		
3rd-5th standard	10 (28.6)	14 (29.2)
6th-7th standard	6 (17.1)	5 (10.4)
8th-10th standard	19 (54.3)	29 (60.4)
Region		
Rural	15 (42.9)	16 (33.3)
Urban	20 (57.1)	32 (66.7)
Father education		
Illiterate	18 (51.4)	12 (25.0)
Primary/secondary	8 (22.9)	7 (14.6)
High school	8 (22.9)	22 (45.8)
College	1 (2.9)	7 (14.6)
Power of the right eye in diopters		
−0.5-−0.75 D	28 (80)	24 (50)
≥−1 D	3 (8.5)	16 (33.3)
+0.5-+0.75 D	2 (5.7)	1 (2)
≤+1 D	2 (5.7)	7 (14.6)
Power of the left eye in diopters		
−0.5-−0.75 D	29 (82.9)	21 (43.8)
≥−1 D	2 (5.7)	18 (37.5)
+0.5-+0.75 D	3 (8.5)	2 (4.2)
≤+1 D	1 (2.8)	7 (14.5)
Total	35 (100.0)	48 (100.0)

Table 2: Reasons for non-compliance with spectacle-wear

Reasons for not wearing spectacles	Number of children (*n* = 35)	Percentage
Spectacles broken	4	11.4
Spectacles lost	5	14.3
Forgot spectacles at home	11	31.4
Don't feel spectacles are needed	2	5.7
Spectacles caused head ache	3	8.5
Uses spectacles only some time	4	11.4
Concerned about teasing and looks	2	5.7
Parents disapprove of spectacles	4	11.4

In univariate model it was seen that children in the age group of 7-9 years were 2.3 times more likely to show compliance to spectacle-wear and 10-12-year-old children were less likely to be compliant.

Girls were 2.1 times more compliant then boys and children from urban schools were more likely to show compliance. Children having father with higher level of education were found to show better compliance (OR = 5.8) than children whose fathers were illiterate.

But in the multivariate model of logistic regression though females, children in younger age group and children of urban schools showed better compliance, though the association was not statistically significant. Whereas statistical significant association was seen between the children of fathers with lower level of education and non-compliance [Table 3].

DISCUSSION

The compliance in our study may have been moderate due to the unannounced follow-up after 3 months of providing free spectacles and only those actually wearing the spectacles at the time of the visit were termed compliant.

The compliance was 57.8% in this study compared to 29.5% among the rural secondary school children in Pune[8] and 19.5% compliance from rural central India.[9] Yabumoto *et al.* in their study in southern Brazil found that after 10 months of providing free spectacles 73.7% were reported to be wearing spectacles[10] Similarly, in Oman 71.6% of schoolchildren were wearing their spectacles at a 1 year follow-up visit.[11]

Where as in a study conducted by Castanon Holguin *et al.* on school aged Mexican children showed that at the time of unannounced follow-up after 4-18 months after providing free spectacle only 13.4% of children had the spectacles[3] Likewise few other studies on compliance where spectacle were provided through school-based programs have found uniformly poor compliance.[12,13] Directly comparing spectacle use compliance among different studies would be difficult because the time frame and the methods used to determine compliance differ from one study to another.

Out of the 35 children not wearing spectacles majority of them (31.4%) had forgot their spectacles at home. 14.3% of the students had lost their spectacles and 11.4% of the children told that their spectacles were broken. Parents disapproved of spectacles in 11.4%. Very few (5.7%) showed concern about friends teasing them and appearance in this study, whereas "teased by other children" was the single most common cause of non-wear in a study conducted in Pune.[8]

Other reasons were similar to the ones, given by the Mexican children in a study conducted by Castanon Holguin *et al.*[3]

Our study showed that girls were 2.1 times more compliant then boys. Few more studies have found girls significantly more likely to wear their spectacles than boys,[7,11,12,14] but there are other studies, which have not found gender to be significantly associated with spectacle-wear.[3,4,9,10] None of the similar studies found boys more compliant to spectacle-wear compared to girls.

In this study children in the age group of 7-9 years were 2.3 times more likely to show compliance to spectacle-wear and 10-12-year-old

Table 3: Univariate and multivariate (logistic regression) analysis of compliance

Variables	Univariate			Multivariate		
	P value	OR	95% CI	*P* value	OR	95% CI
Age in years						
7-9 years	0.251	2.30	0.65-7.96	0.616	1.89	0.16-2.16
10-12 years	0.074#	0.38	0.14-1.08	0.117	0.06	1.36-3.08
13-15 years	0.655	1.28	0.53-3.10	REF		
Gender						
Male	0.087#	0.46	0.19-1.12	0.433	0.67	0.25-1.81
Female	0.087#	2.16	0.88-5.27	REF		
Class						
3rd-5th standard	1.000	1.03	0.39-2.69	0.799	0.77	0.10-5.72
6th-7th standard	0.514	0.56	0.16-2.02	—	—	—
8th-10th standard	0.655	1.29	0.53-3.10	REF		
Region						
Rural	0.491	0.67	0.27-1.64	0.164	0.44	0.13-1.41
Urban	0.491	1.50	0.61-3.68	REF		
Father education						
Illiterate	0.020*	0.31	0.12-0.79	0.052#	0.082	0.007-1.03
Primary/secondary	0.393	0.58	0.18-1.77	0.075#	0.083	0.005-1.28
High school	0.039*	2.86	1.08-7.55	0.318	0.27	0.02-3.51
College	0.130	5.80	0.68-49.53	REF		

#Suggestive significance (P: $0.05 < P < 0.10$), *Significant (P: $0.01 < P \leq 0.05$). REF = Reference group for odds ratio, CI = Confidence interval, OR = Odds ratio

children were less likely to be compliant. These findings matched with a study from Mexico where Castanon Holguin *et al.* observed that older children were less likely to be complaint than younger ones[3] where as two more studies that had studied children of a wider age group found older teens more likely to wear their spectacles than younger children.[7,11] Age was not found to be associated with spectacle-wear in most other studies.[4,6,9,10,12] These variations may be due to the limited age range like only secondary school, or only primary school students included in most of the studies.

Children from urban schools were more likely to show compliance in our study. This was akin to results observed by Congdon *et al.* in South Africa where urban children ($P = 0.02$) were more likely to be wearing their spectacles during the follow-up,[12] but unlike Mexican children where rural were more compliant.[3]

Gogate *et al.* in their study in Pune observed that Spectacles non-compliance was significantly related to lack of education in the father ($P = 0.016$)[8] this finding is consistent with our study. We found that children having father with higher level of education were found to be better compliant (OR = 5.8) than children whose fathers were illiterate. Whereas parental education level was not significantly associated with spectacle-wear in children in other studies that have looked at this factor.[4,14,15]

The factors that has been found to be associated with wearing spectacles in most of the similar studies were poorer visual acuity and higher degree of myopia.[3,4,7,9,11,15] In our sample, spectacle-wear was significantly associated with power in either eye, children who had power of −1 D and below showed better compliance ($P = 0.001$) where as children with −0.5 D of power were more non-compliant ($P = 0.001$) like Castanon Holguin *et al.*[3] who also found that only 2% of their participants with spherical equivalents of −0.50 D were wearing spectacles during follow-up. However, a study by Li *et al.* found that even with high amounts of refractive error, spectacles are frequently not worn.[15] Whereas Congdon *et al.* in south Africa[12] and Yabumoto *et al.*[10] found that degree of refractive error was not a predictor of better spectacle-wear compliance.

There were some limitations in our study, only children actually wearing the spectacles at the time of follow-up were considered as compliant. Another limitation is that the choices given as possible reasons for why they were not wearing their spectacles were limited in this community based study.

The findings on spectacle-wear in this study cannot be generalized to children who got their spectacles by traditional methods. Children who are prescribed spectacles in a clinic or hospital setting may be more likely to wear their spectacles than children who participated in a school based program for many reasons. One of the reasons may be the initiative and involvement of the parents in clinical setting, the parent is present with the child during examination which allows the doctor to explain the child's need for spectacles. Unfortunately we could not involve the parents in this study either during examination or dispensing the spectacles. Often spectacles that was purchased have greater value than those received free of cost. A Tanzanian study demonstrated that spectacles dispensed free of cost, were used less as compared to those in which the recipients paid for them.[16]

CONCLUSION

Though spectacles were provided free of cost the compliance was only moderate in this study. One of the risk factor for non-compliance with in the present study was older age and prevalence of refractive errors is known to increases with age[2,4,9] hence early intervention when a child is younger and more likely to comply is

recommended. This may allow the child to be compliant at a later age when the risk of refractive errors is higher.

Providing spectacles that are attractive and durable can improve compliance. School teachers play a great role in the compliance of children with spectacle-wear. In this study, 57.8% of the children were wearing spectacles at the time of follow-up and most of them did so because the class teachers insisted on wearing the spectacles provided, during the class. Similarly, involving and educating the parents regarding the child's need for spectacle correction can tremendously improve compliance.

Success of such programs lies in children's compliance and not just provision of spectacles. More population based studies with larger sample should be conducted to assess the determinants of the spectacle use and the barriers to spectacle use should be addressed.

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