

Prevalence of spectacle use and amblyopia among young people presenting to a tertiary care institution of Bihar

Sinha S.¹, Sinha R.K.², Nishant P.³

¹Dr. Sony Sinha, Associate Professor, Department of Ophthalmology, ²Dr. Ranjeet Kumar Sinha, Associate Professor, Department of Community Medicine, ³Prateek Nishant, Former Junior Resident; all authors are affiliated with Patna Medical College, Patna, Bihar, India.

Corresponding Author: Dr. Ranjeet Kumar Sinha, Associate Professor, Department of Community Medicine, Patna Medical College, Patna, Bihar, India. E-mail: dr.ranjeetsinha@gmail.com

Abstract

Introduction: This study intended to estimate the prevalence of spectacle use and distribution of amblyopia in young people presenting to the Ophthalmology outpatient department of a tertiary care institution of Bihar, India. **Materials and Methods:** This hospital-based prospective study was conducted over a period of 2 months amongst patients aged 10-24 years with refractive errors (in one or both eyes), whose refractive status, use of spectacle sat about the time of check-up and presence or absence of amblyopia were recorded. **Results:** Of 1482 young people, 335 (22.6%) were already using spectacle sat about the time of check-up. Of these, 276 (82.4%) had myopic errors in one or both eyes, 58 (17.3%) had hypermetropic errors in one or both eyes, and one (0.3%) had mixed astigmatism in both eyes. Of the 1257 (84.8% of all) young people whose both eyes were ametropic and included for consideration, 186 (14.8%) were found to have anisometropia and of these, 78 (about 42%) met the criteria for amblyopia. Overall 106 (about 7.2%, 95% CI 6.0-8.7) young people were found to be amblyopic (odds ratio = 54.7, p<0.0001). **Conclusion:** Only a small proportion of young people with refractive errors presenting to our tertiary OPD were spectacle-users, indicating inadequacy or lack of utilization of refraction facilities or motivation amongst patients. A strong association of anisometropia with amblyopia was observed. These findings emphasize the need for early detection and correction of refractive errors through community and school-based screening programmes to prevent amblyopia.

Keywords: Amblyopia, Anisometropia, Bilateral ametropia, Prevalence, Refractive correction, Young people

Introduction

The World Health Organization (WHO) identifies uncorrected refractive errors as a major cause of moderate to severe visual impairment worldwide, amounting to about 53% of all causes of visual impairment. About 12 million children aged less than 15 years are visually impaired due to refractive errors [1]. 'Vision 2020: the Right to Sight' is a global initiative of the WHO and International Agency for Prevention of Blindness (IAPB) to eliminate the main causes of avoidable blindness by giving priority to refractive errors, among other entities [2].

Majority of studies enquiring into the prevalence of refractive error and amblyopia are population-based, and none focuses specifically on the 10 to 24 years age group. Rohul et al from a tertiary institution in Kashmir

found that about 86% refractive errors were isometric and 14% anisometric [3]. It has been recognized in numerous studies that with anisometropia, moderate to high hypermetropia or astigmatism, there is a strong association of amblyopia especially in early childhood [4-11]. Weakley et al found that anisometropia contributes significantly to the burden of ocular morbidity, being closely associated with amblyopia [4].

For children ≥ 10 years of age, the problem of amblyopia leads to a worse visual prognosis. Lin et al observed that children do not complain of defective vision, and may not even be aware of their problem [12]. They adjust to poor eyesight by sitting near the blackboard, holding books closer to their eyes, squeezing the eyelids and even avoiding work requiring visual concentration and this warrants early detection and treatment to prevent impaired scholastic performance and permanent disability. Thus, various

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researches have emphasized the importance of early detection and treatment of amblyopia [8, 13]. Population based studies about the prevalence of spectacle-use in our region are mostly derived from school-screening data, and therefore it is not possible to determine the burden it poses to the tertiary eye care system [14]. A hospital-based study from West Bengal found that only 40 of 255 (only about 16%) children aged 5-15 years with refractive errors were using spectacles, whereas the rest were newly diagnosed at their tertiary institution [15].

A study from Uttarakhand found that only about 22% of their subjects aged 5-15 years were using spectacles previously [16]. In the Rapid Assessment of Refractive Errors (RARE) Study from Andhra Pradesh, a quarter of those with uncorrected refractive errors did not feel the need for correction because they did not face problems in their day-to-day tasks [17]. In addition, the Andhra Pradesh Eye Disease Study found that nearly one-third of the subjects with correctable visual

impairment discontinued the use of spectacles, either because they felt the prescription was wrong or because they felt the spectacles were uncomfortable [18].

The reasons for young people presenting to the tertiary OPD for refraction and prescription of glasses have been enumerated in our earlier publication [19].

However, no published studies report the prevalence of spectacle-use in outpatient attendees and the hospital burden of amblyopia in patients of refractive errors in the age group 10-24 years in our region. Hence, this study intended to estimate prevalence of spectacle use and amblyopia in young people aged 10-24 years [20], who present to the OPD of a tertiary care institution of Bihar. The objectives were to determine the proportion of young people who are already using refractive correction vis-à-vis those newly diagnosed at the tertiary OPD as having a refractive error, and to estimate the proportion, severity and laterality of amblyopia in young people with refractive errors.

Material and Methods

Study design: This study was a hospital based, prospective, descriptive study undertaken in the outpatient department of Ophthalmology of Patna Medical College Hospital, a tertiary care institute in Bihar, India.

Ethical consideration & permission: The study conformed to the principles of the Declaration of Helsinki. The Indian Council of Medical Research (ICMR) as well as the Institutional Ethics Committee approved the study protocol. Accordingly, informed consent notes presented to the subjects elucidated the purpose of the study, clearly mentioning to them that the study would report only the variables related to their refractive condition, and not their identities or other confidential information.

Sampling methods and sample size calculation: Patients in the age group of 10-24 years presenting with refractive errors to the out-patient department of ophthalmology during the study period were taken as study subjects.

Inclusion criteria: Routine patients presenting with headache and/or visual disturbances were investigated for the presence of refractive error in their eyes. Consenting individuals in the age group of 10-24 years with diagnosed refractive error (in one or both eyes) were included in the study sample.

Exclusion criteria: Young people presenting with bilateral organic defects such as strabismus, corneal opacity, opacity of the lens, and choroid and retinal disorders were excluded [21]. Eyes with unilateral organic defects were also excluded from consideration.

Data collection procedure: Data were collected on all working days (Monday through Saturday) during the study period using a pre-designed structured interview schedule. Information was recorded on the refractive status of the patient, whether the patients were already using spectacles or any other form of refractive correction, and whether amblyopia was present or not.

Refractive errors were classified as shown in Table 1. Amblyopia was considered as the cause of visual impairment in eyes with best corrected visual acuity of 20/40 or worse and no apparent organic lesion, so long as one or more of the following criteria were met [22]:

- Esotropia, exotropia, or vertical tropia at 4 metres fixation; or exotropia or vertical tropia at 50 centimetres
- Anisometropia (at least 2.00 D spherical equivalent), and
- Bilateral ametropia (at least 6.00 D spherical equivalent).

Amblyopia was further classified as moderate and severe [23], according to best-corrected visual acuity (BCVA) in the worse eye at presentation, unilateral (anisometropic) and bilateral (isometropic i.e. bilateral ametropic), as shown in Table 1.

Table-1: Classification of refractive errors and amblyopia used in the present study [22,23].

Type of refractive errors	1. Myopic Errors	Myopia Simple Myopic Astigmatism Compound Myopic Astigmatism
	2. Hypermetropic Errors	Hypermetropia Simple Hypermetropic Astigmatism Compound Hypermetropic Astigmatism
	3. Mixed Astigmatism	
Degree of amblyopia	1. Moderate amblyopia	BCVA 20/40 - 20/100 in worse eye
	2. Severe amblyopia	BCVA 20/100 - 20/400 in worse eye

Apart from those who were actually wearing refractive correction, those who had lost or broken their spectacles within the past two weeks were also considered as using spectacles at about the time of check-up.

Data analysis: Raw data from the study was entered in Microsoft Excel Spreadsheet (Microsoft Corporation, USA). Statistical Analyses were performed using the software SPSS 16.0 for Windows (Statistical Package for the Social Sciences, SPSS Inc., USA). Percentage responses, means, 95% confidence intervals and odds ratio were calculated. For qualitative analysis, the Chi-Square test was employed as the test for significance, taking $p < 0.05$ as significant.

Results

The study sample consisted of 1482 young people aged 10-24 years who were diagnosed as having refractive errors.

Table-2: Young people with refractive errors in the study sample

	Parameters	Number	Percentage
A.	Refractive Errors (N=1482)		
	a. Newly Diagnosed	1147	77.4
	b. Already using spectacles	335	22.6
	i. Myopic errors	276	82.4
	ii. Hypermetropic errors	58	17.3
	iii. Mixed Astigmatism	1	0.3
B.	Status of young people with refractive errors (N=1482)		
	a. Patients with both eyes ametropic with no detectable organic disease	1257	84.8
	b. Patients with one eye ametropic and other emmetropic	210	14.2
	c. Patients with one eye ametropic and other affected from or lost to organic disease	15	1.0
C.	Ametropia (n=1467)		
	a. Anisometropia	217	14.8
	b. Isometropia	1250	85.2
D.	Association with Amblyopia (n=1467)		
	a. Present (n=106, 7.2%)		
	i. in Anisometropia	90	84.9
	ii. in Isometropia	16	15.1
	b. Absent (n=1361, 92.8%)		
	i. in Anisometropia	127	9.3
ii. in Isometropia	1234	90.7	
E.	Degree of Amblyopia (n=106)		
	a. Moderate	93	87.7
	b. Severe	13	12.3

Of these, 335 subjects (23%) were already using spectacles (or other forms of refractive correction) at about the time of check-up while 1147 (77%) were newly diagnosed with refractive errors at the tertiary OPD. There were 210 patients with unilateral ametropia, and 15 patients who had ametropia in one eye, and the other eye affected from or lost to organic diseases (Table 2).

Of the 335 spectacle-users, 276 (82.4%) had myopic errors in one or both eyes, 58 (17.3%) had hypermetropic errors in one or both eyes, and one (0.3%) had mixed astigmatism in both eyes. No patient was found to have myopic error in one eye and hypermetropic in the other. On the other hand, among 1257 young people whose both eyes were ametropic and included for consideration, 186 (about 14.7%) were found to have anisometropia and of these, 78 (42%) met the criteria for amblyopia. Likewise, among the 210 young people who were found to be emmetropic in one eye and ametropic in the other, 31 (14.7%) had anisometropia and 12 (38.7%) had amblyopia. Overall, 106 (about 7.2%, 95% CI 6.0-8.7) young people were found to be amblyopic. Amblyopia was found to be moderate in about 88% and severe in about 12% (Table 2). Among the 217 subjects with anisometropia, about 41.5% had amblyopia, and the association of anisometropia with amblyopia was statistically significant ($p < 0.001$, odds ratio = 54.7, Table 3). Of 106 amblyopes in total, 90 (about 85%) had unilateral (anisometropic) and 16 (15%) had bilateral ametropic amblyopia. The duration of use of spectacles was 6.8 ± 1.24 years (mean \pm SD, 95% CI 6.67-6.93).

Table-3: Association of anisometropia with amblyopia (n=1467).

		Anisometropia	Isometropia	Total	$\chi^2 = 445.63$, df=1, $p < 0.001$, Odds Ratio=54.7
Amblyopia	Present	90 (41.5)	16 (1.3)	106 (7.2)	
	Not Present	127 (58.5)	1234 (98.7)	1361 (92.8)	
Total		217 (100.0)	1250 (100.0)	1467 (100.0)	

Discussion

This study was conducted on a large sample of 1482 young people aged 10-24 years with refractive errors presenting to the OPD of a tertiary care institution of Bihar, India. Only about 23% (335 of the 1482) young people of the study sample were already using spectacles (or other forms of refractive correction) at about the time of check-up, concurrent with the Uttarakhand study [16]. In other words, only two out of nine patients were spectacle-users compared to seven out of nine being non-users, a huge difference for a tertiary hospital indicating inadequate refraction facilities at lower levels of the organizational framework or a lack of their utilization. This was less than that in the APEDS [18] where the prevalence of spectacle-use was 29.5% overall, but far more than the West Bengal study [15], which found it to be 16% in the 5-15 years age group, and a Saudi Arabian study [24], which found it to be only 9.4% in the 6-14 years age-group.

The APEDS was a community-based study and it may be derived from these observations that the rates of detection of refractive errors as well as the coverage of and compliance to spectacle-use are low in Bihar as compared to Telangana/Andhra Pradesh. Of the 335 spectacle-users, over 82% (276 of 335) had myopic errors in one or both eyes and less than 18% had hypermetropic errors in one or both eyes (Table 2). This

was perhaps because the majority of previously undiagnosed patients were hypermetropic, mostly with good uncorrected/presenting visual acuity and had not visited other centres previously, or had been prescribed spectacles at previous examinations but not used them, or had been under-corrected. Similar facts reported in the RARE study and APEDS from Andhra Pradesh [16, 17], stated many patients with uncorrected refractive errors did not feel the need for correction because they did not face major problems in their day-to-day tasks, or discontinued the spectacles due to incorrect prescription or discomfort. The prevalence of anisometropia found in the present study was approximately 15% in the absence of organic disease. Rohul et al reported a similar prevalence (about 14%) from Kashmir [3], whereas Mittal et al reported a lower prevalence (about 7%) from Uttarakhand [16].

Amblyopia was observed in about 42% of anisometropic young people, amounting to about 7% of the total, which is 10 times of what was reported in a study from Bihar's neighbouring country Nepal [6]. The association of anisometropia, about six folds, odds ratio=54.7, $p < 0.001$ (Table 3) observed in the present study is in strong concordance with several previous studies [5-11]. It was observed that about 85% of amblyopes had anisometropia (90/106) and about 15% had bilateral ametropic amblyopia (16/106). Sapkota et

al from Nepal observed that 29% of their subjects had bilateral amblyopia due to high ametropia [6]. In a study by Rizvi et al, the frequency of amblyopia was found to be 74% in the anisometropia group and anisometropes were found 2.5 times more likely to have amblyopia as compared to ametropes [11]. In the present study, amblyopia was found to be moderate in about 88% of subjects. These findings emphasize the need for early detection of refractive errors through community and school-based screening programmes. Researchers in Sweden and the United Kingdom have suggested screening at the age of four to five years, once the child begins his/her education [8, 13].

The present study has served as an initial inquiry into spectacle-use and amblyopia among the young patient population presenting to tertiary institutions. Further multicentric hospital-based studies would doubtlessly provide greater insight into underlying problems leading to poor spectacle compliance and the burden of amblyopia.

Conclusion

Amblyopia was present in about 7.2% of all young adults who were already using either spectacles or other corrective measures for their refractive errors and in about 42% of anisometropes presenting to the OPD of a tertiary care institution. Amblyopia was found to be moderate in about 88% of subjects. This scenario demands immediate attention as the visual prognosis for uncorrected refractive errors in the investigated age group is grim.

Less than one-fourth of the young people were already using spectacles (or other forms of refractive correction) at about the time of check-up. The rest were newly diagnosed at the tertiary OPD, reflecting deficiency in visual services at peripheral health establishment level for the detection and management of refractive errors and counselling regarding spectacle compliance.

What this study adds to existing knowledge?

The present study has put forward a more logical classification of refractive errors based on whether rays from infinity converge in front or behind the retina. Myopic errors thus included myopia, myopic astigmatism (simple and compound), and hypermetropic errors thus included hypermetropia and hypermetropic astigmatism (simple and compound). There is need to strengthen school screening programmes, vision centres and secondary eye care centres, and equip them with proper refraction facilities in order to serve the needs of the young people with refractive errors and further to

prevent consequential amblyopia. In addition, there is need to establish a network of trained opticians and counsellors in order to provide correct spectacles and encourage spectacle-use among those who require it to help achieve Vision 2020 norms.

Authors' Contributions

1. Dr Sony Sinha: Conceived the original idea, clinical work, manuscript writing and revision.
2. Dr Ranjeet Kumar Sinha: Maintenance of data, statistical analysis, manuscript writing and revision.
3. Dr Prateek Nishant: Conceived the original idea, preparation of data collection tool, data collection, manuscript writing and revision.

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References

1. Vision impairment and blindness [Internet]. World Health Organization. World Health Organization; [cited 2019 June 30] Available from: <https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment>
2. Universal Eye Health – A global Action Plan 2014-2019 [Internet]. World Health Organisation. 2018. [cited 2019 June 30] Available from <http://www.who.int/blindness/actionplan/en/>
3. Rohul J, Maqbool A, Hussain SA, Shamila H, Anjum F, Hamdani ZA. Prevalence of refractive errors in adolescents in out-patient attendees of the preventive ophthalmology clinic of community medicine, SKIMS, Kashmir, India. *Nitte University J Health Sci.* 2013;3 (1):17.
4. Weakley DR Jr, Birch E, Kip K. The role of anisometropia in the development of accommodative esotropia. *J AAPOS.* 2001; 5(3): 153-7. DOI:10.1067/mpa.2001.114662
5. Ingram RM, Walker C, Wilson JM, Arnold PE, Dally S. Prediction of amblyopia and squint by means of refraction at age 1 year. *Br J Ophthalmol.* 1986;70 (1): 12-5. DOI:10.1136/bjo.70.1.12

6. Sapkota K, Pirouzian A, Matta NS. Prevalence of amblyopia and patterns of refractive error in the amblyopic children of a tertiary eye care center of Nepal. *Nepal J Ophthalmol*. 2013;5(1):38-44. DOI: <http://dx.doi.org/10.3126/nepjoph.v5i1.7820>.
7. IP JM, Robaei D, Kifley A, Wang JJ, Rose KA, Mitchell P. Prevalence of hyperopia and associations with eye findings in 6- and 12-year-olds. *Ophthalmol*. 2008;115(4):678-685.e1. Epub 2007 Jul 30. DOI:10.1016/j.ophtha.2007.04.061
8. Sjöstrand J, Abrahamsson M. Risk factors in amblyopia. *Eye (Lond)*. 1990;4 (Pt 6):787-93. DOI:10.1038/eye.1990.124
9. Klimek DL, Cruz OA, Scott WE, Davitt BV. Isoametropic amblyopia due to high hyperopia in children. *J AAPOS*. 2004;8(4):310-3. DOI:10.1016/S1091853104000989
10. Robaei D, Rose KA, Ojaimi E, Kifley A, Martin FJ, Mitchell P. Causes and associations of amblyopia in a population-based sample of 6-year-old Australian children. *Arch Ophthalmol*. 2006;124(6):878-84. DOI: 10.1001/archophth.124.6.878
11. Ali Raza Rizvi S, Mehmood F, Gupta Y, Sukul RR. Anisometropia, ametropia and amblyopia and their effect on near visual acuity. *J Ophthalmic Clin Res*. 2015;2:007. DOI: 10.24966/OCR-8887/100007
12. Lin LL, Shih YF, Hsiao CK, Chen CJ. Prevalence of myopia in Taiwanese schoolchildren: 1983 to 2000. *Ann Acad Med Singapore*. 2004;33(1):27-33.
13. Hall DMB, Elliman D. *Health for all children: 4th Report (Medicine)*. UK; OUP Oxford; 2003 (ISBN10:019851588X)
14. Kumari S, Bharati DR, Yadava DK, Choudhary SK. A cross-sectional study on pattern of ocular morbidity and the prevalence of refractive errors among school children of 11 to 16 years in the rural area of Maner, Patna, Bihar, India *J Med Sci Clin Res*. 2019;7(2):244-50. DOI: 10.18535/jmscr/v7i2.46
15. Saha MD, Ranjan A, Islam MN, Mukherji S. Prevalence of Refractive Errors among the School going Children at a Tertiary Center of West Bengal. *Int J Sci Stud*. 2017;5(4):179-82. DOI:10.17354/ijss/2017/360
16. Mittal S, Maitreya A, Dhasmana R. Clinical profile of refractive errors in children in a tertiary care hospital of Northern India. *Int J Community Med Public Health*. 2016;3(5):1189-94. DOI: 10.18203/2394-6040.ijcmph.2016.1382.
17. Marmamula S, Keeffe JE, Raman U, Rao GN. Population-based cross-sectional study of barriers to utilisation of refraction services in South India: Rapid Assessment of Refractive Errors (RARE) Study. *BMJ Open*. 2011; 1(1): e000172. DOI: 10.1136/bmjopen-2011-000172.
18. Dandona R, Dandona L, Kovai V, Giridhar P, Prasad MN, Srinivas M. Population-based study of spectacles use in southern India. *Indian J Ophthalmol*. 2002;50(2):145.
19. Nishant P, Sinha S, Sinha RK. Refraction-seeking behaviour among young people presenting to a medical college hospital of Bihar. *Ind J Clin Exp Ophthalmol*. 2018;4(2):254-57. DOI:10.18231/2395-1451.2018.0056
20. Park K. *Textbook of Preventive and Social Medicine*. 22nd ed. Bhopal: M/S Banarsidas Bhanot; 2013. p 548.
21. Dandona R, Dandona L, Srinivas M, Sahare P, Narsaiah S, Munoz SR, et al. Refractive error in children in a rural population in India. *Invest Ophthalmol Vis Sci*. 2002;43(3):615-22.
22. Pediatric Eye Disease Investigator Group. A comparison of atropine and patching treatments for moderate amblyopia by patient age, cause of amblyopia, depth of amblyopia, and other factors. *Ophthalmology*. 2003; 110 (8):1632-7. DOI: 10.1016/S0161-6420(03)00500-1
23. Holmes JM, Kraker RT, Beck RW, Birch EE, Cotter SA, Everett DF, et al. A randomized trial of prescribed patching regimens for treatment of severe amblyopia in children. *Ophthalmol*. 2003; 110(11): 2075-87. DOI: <https://doi.org/10.1016/j.ophtha.2003.08.001>
24. Wadaani FAA, Amin TT, Ali A, Khan AR. Prevalence and pattern of refractive errors among primary school children in Al Hassa, Saudi Arabia. *Glob J Health Sci*. 2012;5(1):125-34. DOI: 10.5539/gjhs.v5n1p125.

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