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Dr. Md. Farhad Bin Siddique
Registrar, Department of Ophthalmology, National Institute of Ophthalmology & Hospital, Dhaka, Bangladesh

Dr. Abir Bin Sajj
Consultant, Department of Cornea and Refractive Surgery, Vision Eye Hospital, Dhaka, Bangladesh

Dr. Tohura Sharmin
Assistant Professor, Department of Community Medicine, Ad-Din Women's Medical College, Dhaka, Bangladesh

Dr. Md. Adnan Islam
Indoor Medical Officer, Department of Community Ophthalmology, Gopalgonj Eye Hospital and Training Institute, Gopalgonj, Bangladesh

Dr. Md. Ariful Islam
Assistant Professor, Department of Ophthalmology, Army Medical College & CMH, Chattogram, Bangladesh

Dr. Nusaffarin Khan
Assistant Professor, Department of Ophthalmology, BIHS General Hospital, Dhaka, Bangladesh

Dr. M. G. Faruk Hossain
Assistant Professor, Department of Community Ophthalmology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

Dr. Syed Abdul Wadud
Professor & Chairman, Department of Ophthalmology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

Corresponding Author:
Dr. Md. Farhad Bin Siddique
Registrar, Department of Ophthalmology, National Institute of Ophthalmology & Hospital, Dhaka, Bangladesh
Email:farhadsiddique42@gmail.com

Visual outcome after full refractive correction of anisometropic amblyopia among 5-15 years old children

Md. Farhad Bin Siddique, Abir Bin Sajj, Tohura Sharmin, Md. Adnan Islam, Md. Ariful Islam, Nusaffarin Khan, M. G. Faruk Hossain and Syed Abdul Wadud

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Abstract
Background: Anisometropic amblyopia is the most common cause of visual morbidity in childhood which is characterized by reduced spatial vision due to refractive error.
Objective: This study was planned to determine the visual outcome after full refractive correction of anisometropic amblyopia among 5-15-year-old children.
Methodology: The Cross-sectional interventional study was conducted in the Departments of Community Ophthalmology and Ophthalmology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka from March 2017 to August 2019.
Result: A total of 52 untreated children were included in the study with 3 missing the follow-ups. The mean age of the subjects of our study was 9.47 years, range of age was 5-15 years. 44 (89.8%) patients were bilateral & 5 (10.2%) were unilateral. Visual acuity improved from baseline by 2 or more lines (95% CI) in 85% of the patients and by 3 or more lines in 49.3%. This improvement was statistically significant (p<0.0001). Additionally, amblyopia resolved in 7 of 49 (15%) patients. Improvement of visual acuity continued beyond the initial 12 weeks of spectacle wearing for 37 (75.5%) of the 49 patients completing the initial 12-week visit, after completing 24 weeks, it was 26 (53.1%). The mean visual acuity of the right eyes at baseline was 0.45 log MAR unit and the mean visual acuity of the left eyes at baseline was 0.51 log MAR unit. The total improvement in the right eye was 0.21 log MAR unit. Average improvement in both eyes 0.215 log MAR unit.
Conclusion: Results show that refractive correction is a powerful treatment modality for young children with anisometropic amblyopia. If we can detect them earlier then we should be able to give these children a better vision & prosperous life.

Keywords: Anisometropia, amblyopia, refraction, cycloplegia

Introduction
Amblyopia is the unilateral, or bilateral, decrease in the Best Corrected Visual Acuity (BCVA) caused from vision deprivation and/or abnormal binocular interaction, for which there is no identifiable pathology of the eye or visual pathways. There are 5 types of amblyopia; Anisometropic; Strabismic; Stimulus deprivation; bilateral ametropia and Meridional amblyopia [1]. Anisometropic amblyopia is common type of amblyopia in children, occurring twice as frequently as strabismic amblyopia. Anisometropia is when vision in one doesn't correspond with the fellow eye. The refractive status of two eyes will be different. Anisometropic amblyopia means development of amblyopia in any eye due to refractive error difference in two eyes. In other words, amblyopia, it is called lazy eye, is a developmental neurological abnormal condition. Here, one eye becomes dominant while the other becomes lazy and the brain starts to ignore the signals from the lazy eye and favors the signals from one eye may lead to visual impairment or, in some case complete blindness, which is called mono ocular blindness [2]. When the total refraction of two eyes is unequal or different, this condition is called anisometropia [3]. In case of anisometropia, a disparity of more than 1D in Hypermetropic patient is enough to cause amblyopia of more hypermetropic eye. For near vision, the more hypermetropic eye is therefore remaining out of focus. In case of myopia more than 2.5D of disparity between eyes has a higher chance of amblyopia [3].

The prevalence anisometropic amblyopia in patients of amblyopia is 25% to 60%. Hence, not all patients with anisometropia develop amblyopia [4]. Anisometropic amblyopia may be produced due to loss of foveal resolution in the less focused eye, by localized mechanisms of foveal inhibition or development of a suppression scotoma or by loss of binocular function (perhaps caused by loss of resolution or by a suppression scotoma). Risk factors of anisometropic amblyopia can be divided into ocular and non-ocular risk factors. It is associated with refractive error, strabismus, or anisometropia, congenital nasolacrimal duct obstruction. One-third of the population will present a refractive error (myopia, hyperopia, astigmatism). In total 5.8-11.6% of the United States, Western European and Australian population suffer from hyperopia and 16.4-26.6% from myopia [5]. Different studies investigating perinatal, socioeconomic and demographic risks identified non-ocular factors associated with anisometropic amblyopia such as maternal smoking during pregnancy, prematurity and neonatal intensive care unit hospitalization. Anisometropia causes highest number of amblyopia among children throughout the world. Early detection of amblyopia associated with anisometropia and treatment of any refractive error, can reduce the overall prevalence of anisometropic amblyopia. It's a preventable & modifiable disease. Various researchers of different countries reported about the improvement after full refractive correction in anisometropic amblyopia. Great emphasis should be given on creating awareness through campaigns in day care centers, pre-schools, schools for teachers and among parents that early visual assessment of a child lead to early detection, prompt diagnosis and treatment of amblyopia in this group.

Methods and Materials

A cross-sectional interventional study was done on children (5-15 years) who will attend in the OPD of Community Ophthalmology and Department of Ophthalmology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka during period of time march 2017 to august 2019. After obtaining permission from institutional review board (IRB), 49 were included for the study. Data collection sheet was designed according to the objective of the study with clinical examination form.

Sampling Technique: A random sampling technique was used to collect the sample from study population as per inclusion and exclusion criteria.

Data collection procedure: Patients attending at Out Patient Department of Ophthalmology and Community Ophthalmology, Bangabandhu Sheikh Mujib Medical University. The written informed consent was obtained from all participants before enrollment in the study at the time of first screening. The complete clinical evaluation including history, physical examination, relevant ocular examinations-best corrected visual acuity (BCVA), Hirschberg's Test to determine the presence or absence of strabismus, Cover-uncover test to confirm the diagnosis if strabismus present, Ocular motility test, Examination of anterior segment by slit lamp to detect cataract, congenital anomalies like anophthalmos, microphthalmos, large corneas and evidence of previous eye surgery, Cycloplegic (1% cyclopentolate eye drop) refraction using streak retinoscopy, fundoscopy with Direct Ophthalmoscope to rule out any retinal pathology. All findings were recorded in the data collection sheet. Follow-up visits were scheduled at 3 and 6 months. The visits involved an orthoptic examination as described at the first visit, but visual acuity (VA) testing was performed with the prescribed spectacles. The visits at 6 months included a detailed ophthalmologic examination as described at the first visit. During the study, the children's spectacles were changed if needed. Resolution of amblyopia was defined as a VA difference of 1 line or less between the eyes.

Statistical Analysis: Data were processed and analyzed using SPSS, version 22.0 for Windows. The results were presented in tables and figures.

Results

Total 52 children with previously untreated anisometropic amblyopia and considerable refractive error were selected. Three children were dropped out. Among them anisometriopic amblyopia associated with myopia were 8 children, myopic astigmatism were 15 children, hyperopia were 13 children, hypermetropic astigmatism were 9 children and mixed astigmatism were 4 children. The mean age at presentation was 9.47 years. Below tables shows distribution of VA of both eyes at 1st visit among boys and girls.

Table 1: Distribution of visual acuity of right eye among children at 1st visit by sex (N=49)

Visual acuity	Boys		Girls		All	
	n=20	%	n=29	%	N=49	%
6/6	3	15.0	0	0.0	3	6.1
6/9	0	0.0	2	6.9	2	4.1
6/12	1	5.0	2	6.9	3	6.1
6/18	4	20.0	7	24.1	11	22.4
6/24	0	0.0	3	10.3	3	6.1
6/36	7	35.0	8	27.6	15	30.6
6/60	5	25.0	4	13.8	9	18.4
2/60	0	0.0	1	3.4	1	2.0
4/60	0	0.0	1	3.4	1	2.0
5/60	0	0.0	1	3.4	1	2.0
p=.272						

Table 1 shows frequency of refractive error (RE) among boys, maximum visual acuity was 6/36 for 7 children (35%), 6/60 for 5 (25%) & among girls 8 children had 6/36 (27.6%), & 7 girls for 6/18 (24.1%). Above all maximum visual acuity 6/36 group retains 15 children (30.6%), 6/18 (22.4%) group & 6/60 (18.4%) accordingly.

Table 2: Distribution of visual acuity of left eye among children at 1st visit by sex (N=49)

Visual acuity	Boys		Girls		All	
	n=20	%	n=29	%	N=49	%
6/6	2	10.0	1	3.4	3	6.1
6/9	1	5.0	0	0.0	1	2.0
6/12	2	10.0	3	10.3	5	10.2
6/18	3	15.0	2	6.9	5	10.2
6/24	0	0.0	5	17.2	5	10.2
6/36	8	40.0	5	17.2	13	26.5
6/60	3	15.0	7	24.1	10	20.4
5/60	0	0.0	0	0.0	0	0.0
4/60	1	5.0	2	6.9	3	6.1
3/60	0	0.0	2	6.9	2	4.1
2/60	0	0.0	2	6.9	2	4.1
p=.207						

Table 2 shows the frequency of refractive error of left eyes among boys, maximum visual acuity 6/36 for 8 children (40%), 6/60 for 3 (15%) & among girls 7 children had 6/60 (24.1%), & 5 girls for 6/36 (17.2%). visual acuity 6/36 group retains 13 children (26.5%), 10 children have 6/60 (20.4%) accordingly.

Table 3: Distribution of visual acuity of right eye among children 2nd visit by sex (N=49)

Right eye	Boys		Girls		All	
	n=20	%	n=29	%	N=49	%
6/18	3	15.0	8	27.6	11	22.4
6/36	2	10.0	1	3.4	3	6.1
6/60	0	0.0	0	0.0	0	0.0
6/9	3	15.0	7	24.1	10	20.4
6/6	3	15.0	1	3.4	4	8.2
6/12	1	5.0	4	13.8	5	10.2
6/24	8	40.0	7	24.1	15	30.6
2/60	0	0.0	1	3.4	1	2.0
p=.355						

Table 3 shows the frequency of refractive error among boys in 2ndvisit, among boys' maximum refractive error were 6/24 for 8 children (40%), among girls, 6/18 for 8 children (27.6%) & above all maximum complaints were 6/24, 16 subjects (30,6%) in right eye.

Table 4: Distribution of study participants left eye status at 2nd visit by sex (N=49)

Left Eye	Boys		Girls		All	
	n=20	%	n=29	%	N=49	%
6/18 (1)	4	20.0	6	20.7	10	20.4
6/36 (2)	1	5.0	2	6.9	3	6.1
6/60 (3)	3	15.0	2	6.9	5	10.2
6/9 (4)	4	20.0	4	13.8	8	16.3
6/6 (5)	2	10.0	2	6.9	4	8.2
6/12 (6)	2	10.0	3	10.3	5	10.2
6/24 (7)	4	20.0	9	31.0	13	26.5
2/60 (8)	0	0.0	0	0.0	0	0.0
4/60 (9)	0	0.0	1	3.4	1	2.0
p=.928						

Table 4 shows frequency of refractive error of left eyes in 2nd visit, among boys, maximum visual acuity was 6/24 for children (20%), 6/60 for 3 (15%) & among girls 7 children had 6/24 (31%), & 6 girls for 6/18 (20.7%). Above all maximum VA 6/24 group retains 13 children (26.5%), 10 children have 6/18 (20.4%) accordingly.

Table 5: Right and Left Visual acuity status at three visits (N=49)

Right Eye	Right Eye			Left Eye		
	First	Second	Third	First	Second	Third
6/18 (1)	11	15	4	12	12	10
6/36 (2)	3	0	0	3	3	1
6/60 (3)	0	0	1	5	1	0
6/9 (4)	10	10	16	8	7	14
6/6 (5)	4	7	14	4	9	15
6/12 (6)	5	13	14	5	10	8
6/24 (7)	15	3	0	13	5	3
2/60 (8)	1	0	0	0	0	0
4/60 (9)	0	1	0	1	0	0

Table 5 shows improvement of line in Snellen's chart, in case of right eye, 1st visit, 4 patients were 6/6 vision, in 3rd visit its 14, it indicates improvement, 15 patients have 6/24 vision and in 3rd visit every patient had a better vision than 6/24. In Left eye, 6/6 vision was in 4 patients, in 3rd visit it was 16, 6/24 vision in 13 patients, in 3rd visit there only 3 left with 6/24 vision. The improvement was statistically significant.

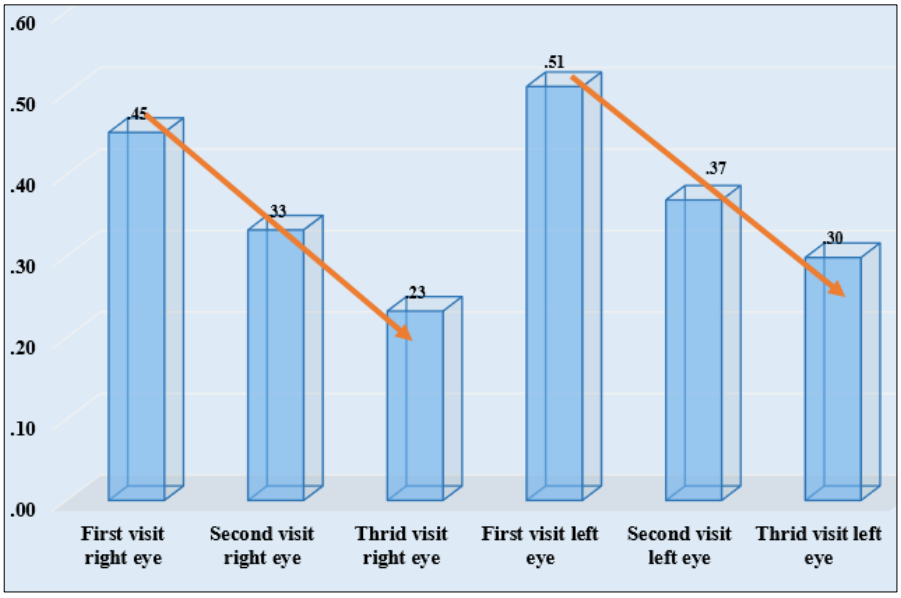

Fig 1: Bar chart showed improvement of refractive status of right eye (N=49)

Figure I shows the improvement of refractive status of right eye. In 1st visit mean VA was 0.45 log MAR unit and in 3rd visit VA improved to 0.23 log MAR unit, in Left eye mean VA changed from 0.51 log MAR unit in 1st visit to & 0.30 log MAR unit on 3rd visit.

Table 6: Mean SD of improvement in log MAR unit, among visits of both eyes

Variable	Mean	*p*<
Right eye		
First visit	.45141±.2243	.0001
Second visit	.3318±.20190	.0001
Third visit	.2322 ±.18142	.0001
Left eye		
First visit	.5078±.27757	.0001
Second visit	.3686±.23791	.0001
Third visit	.2980±.20266	.0001

Table 6 shows mean SD of visual improvement in log MAR unit from 1st visit to 3rd visit in right eye was 0.45 to 0.23 & in left eye from 1st visit to 3rd visit it is 0.51 to 0.29, in all cases it was statistically significant (p<0.0001)

Table 7: Line improvement in Snellen's chart from 1st to 2nd visit and 2nd to 3rd visit of both eyes

Eye	Mean (SD)	*p*<
Second visit Right Eye	1.17 ±.36	.0001
Second visit Left Eye	1.12 ±.69	.0001
Third visit Right Eye	2.02 ±.59	.0001
Third visit Left Eye	1.98 ±.75	.0001

Table 7 shows mean SD of improvement of lines in Snellen's chart from 1st visit to 3rd visit in Right was 2.02 ±.59 lines and in Left eye; from 1st to 3rd visit, improvement was 1.98±.75 lines, in all cases it was statistically significant (p<0.0001).

Table 8: Distribution of laterality of affected eyes pattern of children by sex (N=49)

Eye	Boys		Girls		All	
	n=20	%	n=29	%	N=49	%
Both eye	16	80.0	28	96.6	44	89.8
Left eye only	3	15.0	0	0.0	3	6.1
Right only	1	5.0	1	3.4	2	4.1
p=.092						

Table 8 shows the distribution of refractive error improvement after 6 months. Among, boys 18 children (90%), girls 24 children (82.7%) & over all 42 children (85.7%) achieved the desired level.

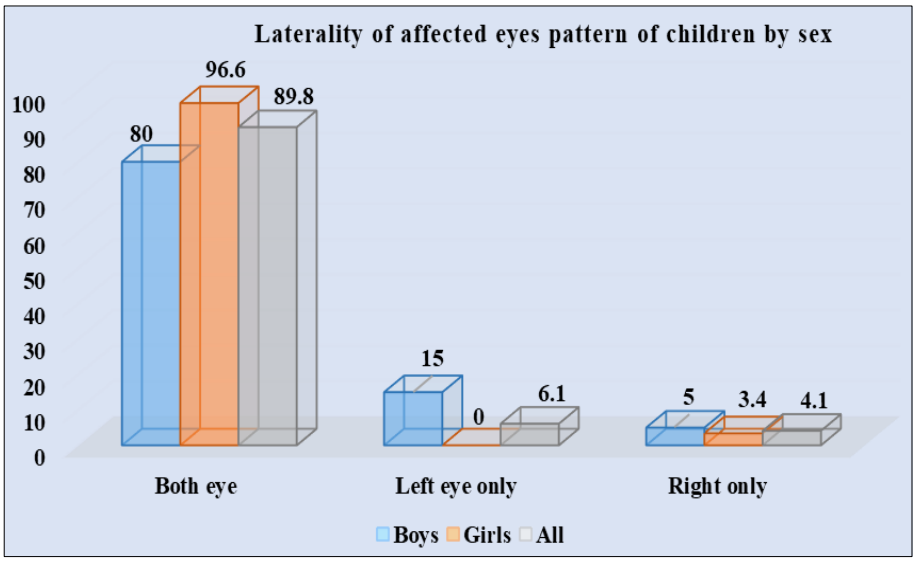

Fig 2: Bar chart showed sex wise laterality of affected eyes pattern of children (N=49)

Discussion

These results show that refractive correction is a powerful treatment modality for young children with anisometropic amblyopia. Children aged 5 to 15 years, who had untreated anisometropic amblyopia with visual acuity that ranged from 6/9 to 4/60 were the study participants. All of our participants were selected as having anisometropic amblyopia without strabismus or any other disease. In this study we found that after full correction of refractive error with spectacles, visual acuity improved in anisometropic amblyopic eyes on an average of 2.3 lines in Snellen's chart. Visual acuity improved from baseline by 2 or more lines (95% CI) in 85% of the patients and by 3 or more lines in 49.3%. This improvement was statistically significant (p<0.0001). Additionally, amblyopia resolved in 7 of 49 (15%) patients with residual amblyopia who continued to be treated with spectacles even after completion of follow up plan. Wallace *et al.* (2007) showed in their study that one-year mean improvement, 3.9 lines (95% CI). The mean improvement at one year for the 84 children with baseline binocular acuity was 3.4 lines (95%CI) [6]. Our study period was 6 months. So, our improvement is similar to the previous study. The mean anisometropia detected in this study was around 2.45 diopters (D). Chen *et al.* (2007) studied 60 children with a mean age of 5.3 years and mean anisometropia detected was 2.95 diopters (D) [7]. So, there is similarity in dioptric value of anoisometropia in these two studies. Improvement of visual acuity continued beyond the

initial 12 weeks of spectacle wearing for 37 (75.5%) of the 49 patients completing the initial 12 weeks visit, after completing 24 weeks, it was 26 (53.1%). Chen *et al.* also showed the improvement in VA in the amblyopic eye was good at 4 to 12 weeks then reached a plateau, after which it improved only slowly [7]. Stewart *et al.* (2005) showed improvement of 6 patients occurred with an average of 16 weeks in their subgroup of the patients with anisometropic amblyopia [8]. So, there is a similarity in both eyes of time duration for improvement of anisometropic amblyopia with above mentioned studies. Afsari *et al.* (2013) studied the improvement in anisometropic amblyopia which was 3.9±0.9 log Mar unit for the spectacles group throughout a year [9]. The study of the Paediatric eye disease investigator group; conducted a study with 84 untreated anisometropic amblyopic patient and amblyopia improved with optical correction by 2 or more than 2 lines in 74% of the patients and resolved in 26% of the patients [10]. This result is similar to that study & the improvement is significant ($p<0.001$).

Conclusion

Anisometropic amblyopia have a significant clinical meaning as they can be the cause of low visual acuity or even blindness. Many studies have taken place to observe the improvement of anisometropic amblyopia after full refractive correction and this study shows refractive error correction is an important treatment modality for anisometropic amblyopia in children. Reduced vision because of anisometropic amblyopia is an important public health problem in young children. If we can detect them earlier then we should be able to give these children a better vision & prosperous life.

Reference

1. Karpecki PM. Kanski's Clinical Ophthalmology: A Systematic Approach, Brad Bowling.
2. Siddiqui AH, Raza SA, Ghazipura A, Hussain MA, Iqbal S, Ahsan K, *et al.* Analysis of association between type of amblyopia and gender at a tertiary care hospital in Karachi. JPMA J Pak Med Assoc. 2016 May 1;66(5):545-548.
3. Irons A, Elkington S. Enhancing learning through formative assessment and feedback. Routledge; c2021 Aug 25.
4. Beauchamp GR, Felius J, Stager Sr DR, Beauchamp CL. The utility of strabismus in adults. Transactions of the American Ophthalmological Society. 2005 Dec;103:164.
5. Mocanu V, Horhat R. Prevalence and risk factors of amblyopia among refractive errors in an Eastern European population. Medicina. 2018 Mar 20;54(1):6.
6. Wallace DK, Chandler DL, Beck RW, Arnold RW, Bacal DA, Birch EE, Felius J, Frazier M, Holmes JM, Hoover D, Klimek DA. Treatment of bilateral refractive amblyopia in children three to less than 10 years of age. American journal of ophthalmology. 2007 Oct 1;144(4):487-496.
7. Chen PL, Chen JT, Tai MC, Fu JJ, Chang CC, Lu DW. Anisometropic amblyopia treated with spectacle correction alone: possible factors predicting success and time to start patching. American journal of ophthalmology. 2007 Jan 1;143(1):54-60.
8. Stewart CE, Fielder AR, Stephens DA, Moseley MJ. Treatment of unilateral amblyopia: factors influencing visual outcome. Investigative ophthalmology & visual science. 2005 Sep 1;46(9):3152-3160.
9. Afsari S, Rose KA, Gole GA, Philip K, Leone JF, French A, *et al.* Prevalence of anisometropia and its association with refractive error and amblyopia in preschool children. British Journal of Ophthalmology. 2013 Sep 1;97(9):1095-1099.
10. Pediatric Eye Disease Investigator Group. Patching vs atropine to treat amblyopia in children aged 7 to 12 years: A randomized trial. Archives of ophthalmology. 2008 Dec 8;126(12):1634-1642.