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A Prospective Study of Treatment Outcomes for Amblyopia

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INTRODUCTION

Amblyopia is the most common cause of monocular visual impairment in children and young- and middle-aged adults.[1,2] Anisometropia, as the most frequent cause of amblyopia, has been evaluated in numerous studies.[3-5] However, prospective studies on treatment of amblopia are very few. Considering the limited studies , there is controversy over refractive correction, treatment outcomes, and whether underlying structural abnormalities are present,[6-12] and some even question the value of attempting treatment at all.[13] The purpose of our study was to evaluate the response of treatment in different age group in form of visual outcome and to know the success rate of treatment in different types of amblyopia. The association of VA improvement with age, degree of anisometropia, level of patching compliance, presence of strabismus, and presence of eccentric fixation were also investigated.

METHOD

The study was carried out in patients attending Regional Institute of Ophthalmology, Gandhi Medical College, Bhopal from July 2008 to November 2009. We included the amblyopic patients up to the age group of 18 years and were willing to take part in study and were ready for regular follow-up. Diagnostic criteria based on visual acuity - A difference in the best-corrected visual acuity (BCVA) between the two eyes of two or more Snellen's lines in the absence of any organic lesion were unilateral amblyopia and A BCVA of less than 6/12 bilaterally on the Snellen's chart in absence of any organic lesion were bilateral amblyopia.

Standard definitions of different subtypes of amblyopia were used for diagnosis.

1. Strabismic amblyopia - This was defined as amblyopia in the presence of a heterotropia at distance or near fixation in the absence of any anisometropia.
2. Anisometropic amblyopia - amblyopic patients in the presence of anisometropia that was 1 D or greater in spherical equivalent, or a 1.5 D or greater difference in astigmatism between both the eyes in the absence of any measurable heterotropia at distance or near.
3. Combined (strabismus+ anisometropic) amblyopia - This included patients with either a heterotropia at distance or near along with anisometropia of 1 D or more in spherical equivalent or a 1,5 D or more difference in astigmatism in any meridian between both the eyes.
4. Sensory deprivation amblyopia - This group included patients with a known documented cause of sensory deprivation

with no primary heterotropias or refractive errors that could be causally related to the amblyopia.

5. Ametropic amblyopia - Patients with refractive errors more than 1 D spherical equivalent in both eyes resulting in subnormal vision in one or both eyes and no associated strabismus or any other ocular pathology were classified under this category. Patients with significant anisometropia (as defined above) along with high refractive errors in both eyes were excluded from this category and were grouped under the anisometropic amblyopia group. Patients with heterotropias for distance or near with bilateral refractive errors more than 1 D spherical equivalent were included under strabismic amblyopia.

In our study amblyopia was divided in two groups-

1. Severe amblyopia- amblyopic patients had best corrected visual acuity 6/36 or less.
2. Moderate amblyopia- amblyopic patients had best corrected visual acuity 6/24 to 6/12. Patients included in the study were subjected to the systemic and ophthalmological examination.

All participants underwent a comprehensive eye examination, including a test for VA at far and near, a cover test at distance and near, a test for stereoacuity with Stereo Fly (Stereo Optical Company, Inc), a test for manifest refraction, a dilated fundus examination with indirect ophthalmoscopy, cycloplegic refraction, monocular fixation using visuoscopy, and A-scan ultrasonographic biometry.For children younger than 7 years, HOTV characters were used, and for children aged 7 years or older, Early Treatment Diabetic Retinopathy Study characters were used. Cycloplegia was induced with 1% cyclopentolate, 1% tropicamide, and 2.5% phenylephrine hydrochloride (1 drop each). Other than refractive error and amblyopia, no participants had any concurrent ocular disease.

TREATMENT

Different modalities were used for treatment of Amblyopia:-

A. Optical correction - In Ametropic and bilateral anisometropic Amblyopia optical correction was given,
B. Occlusion with near vision activity - In unilateral anisometropic Amblyopia and strabismus amblyopic patient were treated by full time occlusion with near vision activity tasks coloring, cutting drawing, tracing, joining dots, working through move, model building games in better eye in according to age of patients.

Duration of occlusion		Age
2 days	-	Upto 2 yrs
3 days	-	Upto 3 yrs.
4 days	-	Upto 4 yrs.
5 days	-	Upto 5 yrs.
6 days	-	> 6 yrs.

There was alternation with one day of occlusion of amblyopic eye when dominant eye opened.

C. Plieopiics- it was used in amblyopic patient with eccentric fixation with the help of haidinger's brushes attached with synaptophore in 5-8 year of age.
D. Surgery-cases of strabismus Amblyopia and anisometropia with strabismus were treated by occlusion with near vision activity or Pleoptics, those patients showed improvement in visual activity advised for strabismus surgery and those patients didn't showed improvement advised for cosmetic strabismus surgery

The Pearson correlation was performed to evaluate the association of final VA and VA improvement with the following parameters: baseline VA, magnitude of anisometropia, and age. The effects of eccentric fixation and patching compliance on final VA and VA improvement were evaluated by the use of the Kendall τ correlation.

RESULTS

OBSERVATIONS

TABLE 1: Distribution Of Patients According To Types Of Amblyopia

S. No.	Types of Amblyopia	No. of Patients	Percentage
1	Anisometropia	63	63%
2	Anisometropia with strabismus	26	26%
3	Amblyopia Ex-anopsia	6	6%
4	Strabismus	3	3%
5	Ametropia	2	2%
	Total	**100**	**100%**

The above table showed 63 cases (63%) had anisometropic amblyopia, 26 cases (26%) had anisometropia with strabismus, 6 cases (6%) had amblyopia-ex-anopsia, 3 cases (3%) had strabismus amblyopia and 2 cases (2%) had ametropic amblyopia.

Total cases of anisometropic and strabismus with anisometropia were 89%.

TABLE NO: 2 Age Distribution Of Cases

S. No.	Age Group (in years)	No. of Patients	Percentage
1.	0-4	09	09%
2.	>4-8	37	37%
3.	>8-12	25	25%
4.	>12-18	29	29%
	Total	**100**	**100%**

In our study, 100 cases of amblyopia were divided into 4 age groups.

Out of 100 cases of amblyopia 9 cases (9%) were of the age group of 0-4 years, 37 cases (37%) were of >4-8 years, 25 cases (25%) of >8-12 years and 29 cases (29%) of >12-18 years.

TABLE NO: 3 Type Of Fixation In Amblyopic Patients

Sr. No.	Type of fixation	No of Fixation	%
1	Uniocular eccentric fixation	21	21%
2	Binocular foveal fixation	77	77%
3	Binocular eccentric fixation	2	2%
	Total	**100**	**100%**

Out of 100 patients, 77% cases showed binocular foveal fixation.

21 % cases showed uniocular foveal fixation in one eye and uniocular eccentric fixation in other eye.

Only 2% cases presented with binocular eccentric fixation.

Table 4: Improvement Of Visual Acuity After Treatment In Different Type Of Amblyopia

Sr. No.	Type of amblyopia	Total patient	No. of showed improvement of visual acuity	%
1.	Anisometropia	63	21	33%
2.	Anisometropia with strabismus	26	6	23.07%
3.	Strabismus	3	1	33%
4.	Amblyopia -ex-anopsia	6	1	16.67%
5.	Ametropia	2	1	50%

Out of 63 anisometropic patients, 21 cases (33%) showed improvement in visual acuity.

Out of 26 anisometropic with strabismus patients, 6 cases (23.07%) showed improvement in visual acuity.

Out of 3 strabismus cases, 1 case (33%) showed improvement in visual acuity.

Out of 6 amblyopia-ex-anopsia cases, 1 case (16.67%) showed improvement in visual acuity.

Out of 2 ametropic cases, 1 case (50%) showed improvement in visual acuity.

TABLE NO.5 Status Of Visual Acuity After Treatment In Different Age Group

Sr. no.	Age group (in years)	Improvement	Stationary
1.	0-4	6(66.67%)	3(33.33%)
2.	>4-8	15(40.54%)	22(59.46%)
3.	>8-12	5(20%)	20(80%)
4.	>12-18	4(13.79%)	25(86.21%)
	Total	**30(30%)**	**70(70%)**

In our study out of 100 cases, 30 cases (30%) showed improvement and 70 cases (70%) showed stationary visual acuity. No case showed regression of vision.

Total no. of cases in age group 0-4 years- 9 cases following modalities adopted for 0-4 year age group

1. 6 cases were treated by optical correction +full time conventional occlusion, in which 5 cases(83.33%) showed improvement, 2 cases showed 3 line improvement and 3 cases showed 2 line improvement.
2. 3 cases were bilateral, treated by only optical correction, in which only 1 case (33.33%) showed 3 lines improvement in visual acuity.

Total 6 cases (66.67%) showed improvement in this age group and 3 cases (33.33%) showed stationary visual acuity.

Total no. of cases in >4-8 years age group -37 cases. Following treatment modalities adopted

1. 1 Case was treated by ptosis surgery then full time conventional occlusion was given, no improvement occurred in visual acuity.
2. 21 Cases were treated by optical correction +full time conventional occlusion, 13(61.90%) cases showed improvement in visual acuity; 4 cases showed 1 line improvement, 7 cases showed 2 line improvement and 2 cases showed 3 line improvement.
3. 10 Cases were bilateral treated by optical correction, no one showed improvement.
4. 5 Cases were treated by optical correction +full time conventional occlusion + pleoptics, 2(40%) cases showed 2 line improvement.

In >4-8 year age group, 15(40.54%) cases showed improvement and 22 cases (59.46%) showed stationary visual acuity.

Total no. of cases in >8-12 age group-25 cases

1. 4 cases were bilateral treated by optical correction, no one showed improvement.
2. 21 cases were treated by optical correction +full time conventional occlusion, in which 5 cases showed improvement in visual acuity; 3 cases showed 1 line improvement and 2 cases showed 2 line improvement.

In >8-12 year age group, 5 cases (20%) showed improvement and 20 cases (80%) showed stationary visual acuity.

Total no. of cases in >12-18 age group -29

1. 4 cases were bilateral treated by optical correction, no one showed improvement.
2. 24 cases were treated by optical correction + full time conventional occlusion, only 4(16.67%) cases showed improvement cases (12.5%) showed 1 line improvement and 1 case(4.16%) showed 2 line improvement.
3. 1 case was advised keratoplasty.

In >12-18 year age group, 4 (13.79%) showed improvement and 25 (86.21%) show stationary visual acuity.

- Out of 3 strabismus case, 1 case showed improvement in visual acuity. Out of 26 anisometropic with strabismus cases, 6 cases showed improvement in visual acuity then patients advised for strabismus surgery according to type of strabismus. Those patients didn't show improvement, advised for cosmetic strabismus surgery according to type of strabismus
- Comparing the final VA with the baseline VA, we found that VA improvement averaged 2.59 lines. Out of 100 amblyopic cases 30% cases showed improvement in visual acuity and 70% cases had stationary visual acuity after treatment.
- 50% cases of ametropic amblyopia showed improvement as compared to 33 % cases of only anisometropia and 33% cases of strabismus amblyopia showed improvement. Anisometropia with Strabismus and amblyopia-ex-anopsia showed less improvement i.e. 23.07% and 16.67% respectively.
- Occlusion showed more improvement i.e. 83.33% as compared to single optical correction showed only 33.33% improvement.

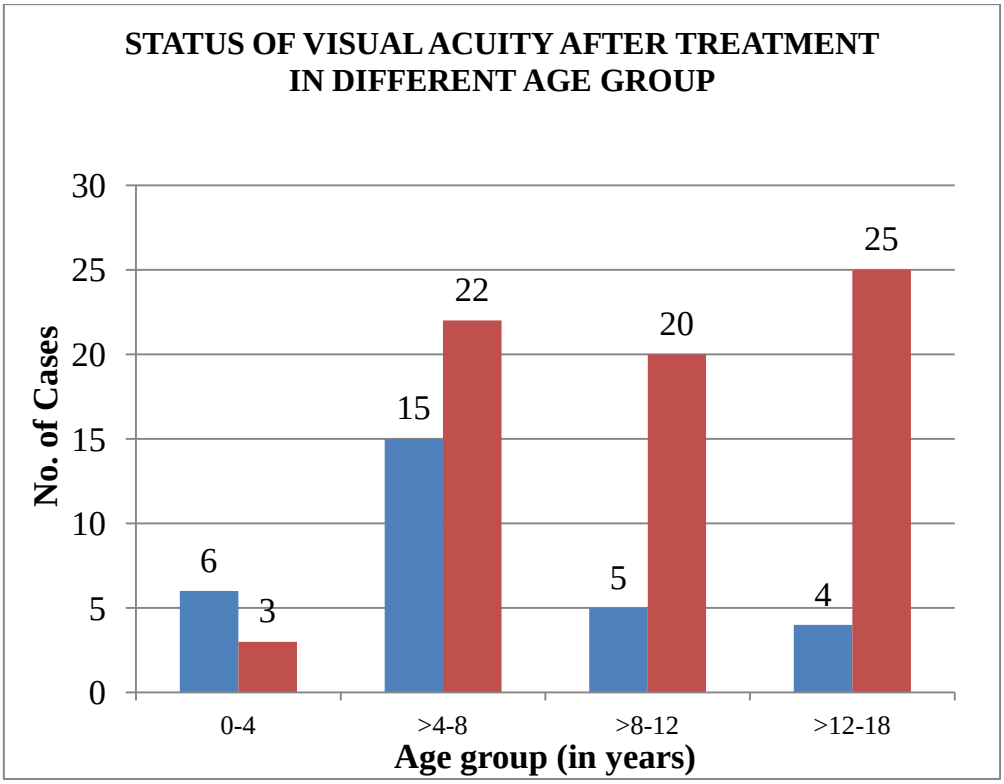

TABLE NO: 6 Status of Visual Acuity after Treatment In Different Age Group

Sr. no.	Improvement	Age Groups (in years)							
		0-4		>4-8		>8-12		>12-18	
		Severe	Moderate	Severe	Moderate	Severe	Moderate	Severe	Moderate
1.	1 line improvement	0	0	1	3	1	2	0	3
2.	2 line improvement	1	2	2	7	0	2	0	1
3.	3 line improvement	1	2	0	2	0	0	0	0
4.	4 line improvement	0	0	0	0	0	0	0	0
5.	No improvement	3	0	14	8	9	11	12	13

In our study, 0-4 year age group 3 cases (1 severe, 2 moderate) showed 2 line improvement and 3 cases (1 severe and 2 moderate) showed 3 line improvement.

In >4-8 age group showed 4 cases(1 severe, 3 moderate) showed 1 line improvement cases (2 severe, 7 moderate)showed 2 line improvement and 2 cases(2 severe) showed 3 line improvement.

In >8-12 age group 3 cases (1 severe, 2 moderate) showed 1 line improvement and 2 cases (moderate) showed 2 line improvement.

In >12-18 age group 3 cases(moderate) showed 1 line improvement and 1 case (moderate)showed 2 line improvement.

The final VA in the amblyopic eye was associated with the baseline VA in the amblyopic eye ($P < .001$), the magnitude of anisometropia ($P < .001$), and the level of patching compliance ($P < 0.05$). The improvement in VA with patching was inversely associated with participants' age ($P < 0.05$) and presence of eccentric fixation ($P = .02$).

DISCUSSION

IMPROVEMENT OF VISUAL ACUITY AFTER TREATMENT IN DIFFERENT TYPE OF AMBLYOPIA

We found that ametropia showed best prognosis, anisometropia and strabismic amblyopia showed same prognosis and amblyopia-ex-anopsia showed worst prognosis.

Our findings correlated with Dr. Subhash Dadeya et al 14reported strabismic amblyopia had best prognosis, because it detected early. Stimulus deprivation amblyopia has the poorest prognosis and anisometropic amblyopia has prognosis somewhere in between. Anisometropia with strabismus amblyopias has prognosis worse than anisometropic amblyopia. For patients with hyperopic isometropic amblyopia the likelihood of improving visual acuity to 20/20 and 20/30 is excellent.

Alse, We found that participants with combined-mechanism amblyopia had less improvement. We had 26 participants in the combined-mechanism group ie strabismus with anisometropia out of which 6 improved. A future study with more participants is necessary to confirm whether the presence of strabismus in addition to myopic anisometropia has an effect on amblyopia treatment outcomes. Furthermore, we found that the presence of eccentric fixation was inversely correlated with VA improvement in the amblyopic eye. Monocular fixation has not been commonly investigated in the recent amblyopia studies.[4,15,16,17] Our results indicate that abnormal monocular fixation may be useful as a predictor of treatment outcomes in amblyopia

STATUS OF VISUAL ACUITY AFTER TREATMENT IN DIFFERENT AGE GROUP

The Pediatric Eye Disease Investigator Group studied 507 amblyopic subjects aged 7 to 17 years and reported that younger age was associated with greater VA improvement.[18] Pollard and Manley[19] reported (without any statistic analysis) no age effect on amblyopia treatment in their 40 amblyopic children aged 2 to 14 years with myopic anisometropia. With 55 subjects aged 7 to 22 years, Sen[9] concluded that, although younger subjects aged 7 to 14 years showed improved VA more often (63.8%) than those aged 15 to 22 years (47.3%), the difference in improvement amount between the 2 groups was not significant. Our finding that the amount of VA improvement was significantly associated with age is consistent with the findings of the Pediatric Eye Disease Investigator Group but different from previous studies on myopic anisometropia.

Holmes JM et al (2003) 4 studied on 7 amblyopic children younger than 7 year resulted that improvement in the ambiyopic eye acuity from baseline to averaged 4.7 lines in the full time occlusion group. In our study 14.81 % cases showed 3 lines improvements. No one showed more than 3 lines improvement

Our findings did not correlate with Subharngkasen I (2003), 20 stimulated the amblyopic eye with synaptophore and patched on good eye ,after 3 months resulted that best visual acuities were

between 20/20 and 20/30 for 90% of patients. In our study only 40% cases showed improvement in age group >4-8 years.

Holmes JM et al (2003) 4used daily patching combined with at least 1 hour of near activities on 66 amblyopic patients, aged 10 to <18 years with in of 20/40 to 20/160 resulted that VA improved 2 or more lines in 27% of patients. In our study 4.16% cases showed 2 line improvement in age group >12-18 age group

Our findings showed less improvement than above mentioned authors may be attributed to lack of awareness of parents about effects of amblyopia and patient compliance was poor. Late presentation of patients was also an additional factor.

CONCLUSION

1) Occlusion was the most effective treatment modality for amblyopia in upto 4 year age group. Good results were obtained in sensitive age group (upto 8 years), above 8 years improvement decreased. Occlusion and pleoptics were useful especially in those amblyopes who had eccentric fixation in age group 5-8 year of age.
2) Moderate amblyopia had good prognosis than severe amblyopia.
3) Ametropic amblyopia had good prognosis than other amblyopias
4) Amblyopia-ex-anopsia had worst prognosis.
5) Only optical correction wasn't effective for bilateral amblyopia.

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