



ORIGINAL ARTICLE

# Anisometropic Amblyopia: Analysis of treatment results with patching of dominant eye and refraction with active visual therapy (AVT) in school age children.

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**ABSTRACT... Objectives:** To analyse the results of Active Visual Therapy with patching and refraction in anisometropic amblyopia in school age children from age 7-15 years. **Study Design:** Analytical study. **Setting:** Department of Ophthalmology, DHQ KDA Teaching Hospital Kohat. **Period:** January 2016 to December 2018. **Material & Methods:** The school age children suffering from anisometropic amblyopia with age range from 7-15 years. Proper documentation proforma was designed for record and follow up of patients. Informed consents were taken from parents of patients and they were specially trained for compliance. Total 41 patients were included comprising 28(68.29%) male and 13(31.70%) female with age range of 7-15 years. Anterior and posterior segments were properly examined. Best corrected visual therapy was recorded. Difference of two or more lines on snellen chart between the two eyes was considered to be anisometropic amblyopia. Before treatment 14(34.14%) patients had BCVA of 6/24, 8(19.51%) patients had 6/36, 10(24.39%) patients had 6/60 and 9(21.95%) patients had CF. Out of 41 patients 29(70.73%) patients were hypermetropic while 12(29.26%) were myopic. The refractive error of amblyopic eyes in spherical equivalent was from + 7 to - 5 diopters. Proper refractive correction was done. Patching of the normal eye was advised for three hours per day at the dose of one week per year of age. The amblyopic eye was exposed to active visual therapy with video games with computer and smart phones. The patients were examined after each three months and improvement in visual acuity and change in refraction was addressed. Results were analysed on the basis of pretreatment and post treatment visual acuity. Finally T-test for regression and co-relation was applied on the post treatment status of visual acuity of 6/24, 6/36, 6/60 and Counting finger with pretreatment status of visual acuity of 6/24, 6/36, 6/60 and Counting finger showing P = 0.005 which is less than 0.05 and is statistically significant. **Results:** Cumulatively after treatment out of 41 patients 10(24.39%) had best corrected visual acuity 6/6, 6(14.63%) had 6/9, 7(17.07%) had 6/12, 7(17.07%) had 6/18, 4(9.75%) had 6/24, 5(12.19%) had 6/60 and 2(4.87%) had best corrected visual acuity of CF. **Conclusion:** Patching of dominant eye and refraction with Active Visual Therapy of amblyopic eye is effective in treatment of anisometropic amblyopia.

**Key words:** Active Visual Therapy (AVT), Best Corrected Visual Acuity (BCVA), Counting Fingers (CF), Visual Acuity (V.A).

## INTRODUCTION

Amblyopia is defined as sub normal development of vision due to developmental defect of spatial processing of vision in the central nerve visual pathway of brain.<sup>1</sup> Majority of cases of monocular visual disability is due to amblyopia.<sup>2</sup> If this disability is passed undetected, it results in permanent visual impairment.

Anisometropic amblyopia is the difference of inter ocular refractive error such that the plain of focus for both eyes is different. Most of the

ophthalmologists are in the opinion that one diopter difference between the two is required to define anisometropic amblyopia.<sup>3,4</sup> But this difference varies between 0.5 diopter and two diopter.<sup>5,6,7</sup> The prevalence of anisometropic amblyopia ranges from 1% to 1.65%.<sup>8</sup> Although there are various types of amblyopia like anisometropic, strabismic, stimulus deprivation, meridional, anisometropic amblyopia contributes one third of amblyopia.<sup>9</sup>

Differences are their among these amblyopia

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but research based out comes may not differentiate.<sup>10,11</sup> Previously amblyopia was thought to be incurable but recent research has proved that ophthalmologists had partial understanding of the plasticity of visual system of human brain and anisometropic amblyopia patients can also get benefit from appropriate therapy.<sup>12</sup> There are various methods of treating anisometropic amblyopia like penalization with atropine, patching of the dominant eye, refraction with AVT of amblyopic eye which might help in the treatment. AVT in the form of video game therapy is quite helpful in the treatment of anisometropic amblyopia.<sup>13</sup>

Standard protocol of amblyopia treatment is occlusion therapy involving patching of the dominant eye while encouraging amblyopic eye to be used for vision. This therapy is effective in 75% of children showing improvement of visual acuity.<sup>14</sup> However, the results decrease with increasing age. The conventional treatment of anisometropic amblyopia has been augmented with new approaches like video games to stimulate and activate neuro modulatory pathway of central visual system.<sup>15</sup>

Specifically active AVT based on perceptual learning with patching of dominant eye and video game with amblyopic eye is an interesting with new area of research that can complement and optimize conventional methods treatment of anisometropic amblyopia.<sup>16,17</sup>

## MATERIAL & METHODS

This study was conducted in Department of Ophthalmology, DHQ KDA Teaching Hospital Kohat from January 2016 to December 2018 on school age children suffering from anisometropic amblyopia with age range from 7-15 years the study was approved by ethical committee of institution (KIMS/Estt/480). Proper documentation proforma was designed for record and follow up of patients. Informed consents were taken from parents of patients and they were specially trained for compliance and follow up.

## RESULTS

Total 55 patients were selected for the study.

However during treatment and follow up phase 14 patients were lost. Hence 41 patients who completed the treatment were included in the study comprising 28(68.29%) male and 13(31.70%) female with age range of 7-15 years (Table-I). Anterior and posterior segments were properly examined. Best corrected visual therapy was recorded. Difference of two or more lines on snellen chart between the two eyes was considered to be anisometropic amblyopia. Out of 41 patients 29(70.73%) were hypermetropic while 12(29.29%) were myopic (Table-II). Before treatment 14(34.14%) patients had BCVA of 6/24, 8(19.51%) patients had 6/36, 10(24.39%) patients had 6/60 and 9(21.95%) patients had CF (Table-III). Proper refractive correction was done. Refractive error of amblyopic eyes in spherical equivalent was from +7 to -5 diopters. Patching of the normal eye was advised for three hours per day at the dose of one week per year of age. The amblyopic eye was exposed to active visual therapy with video games with computer and smart phones. The patients were examined after each three months and improvement in visual acuity and change in refraction was addressed. Results were analyzed on the basis of pretreatment visual acuity. Finally T-test for regression and correlation was applied on the post treatment status of visual acuity of 6/24, 6/36, 6/60 and CF with pretreatment status of visual acuity of 6/24, 6/36, 6/60 and CF showing  $P = 0.005$  which is less than 0.05 and is statistically significant.

In 14 patients of visual acuity 6/24, 7(50%) achieved BCVA of 6/6, 3(21.42%) had 6/9, and 4(28.57%) had achieved BCVA of 6/12 (Table-IV).

In 8 patients of visual acuity 6/36, 3(37.5%) achieved BCVA of 6/6, 3(37.5%) had 6/9, 1(12.5%) patients had 6/12, and 1(12.5%) achieved BCVA 6/18 (Table-V).

In 10 patients of visual acuity 6/60, 2(20%) achieved BCVA 6/12, 6(60%) had 6/18, 1(10%) had 6/24 and 1(10%) had BCVA 6/60 (Table-VI).

Out of 9 patients of visual acuity CF, 3(33.33%) achieved 6/24, 4(44.44%) had 6/60, and 2(22.22%) BCVA CF (Table-VII).

Cumulatively after treatment out of 41 patients 10(24.39%) patients had BCVA 6/6, 6(14.63%) had 6/9, 7(17.07%) had 6/12, 7(17.07%) had 6/18, 4(9.75%) had 6/24, 5(12.19%) had 6/60 and 2(4.87%) patients had BCVA of CF (Table-VIII).

Gender	Number of Patients (%)
Male	28 (68.29%)
Female	13 (31.70%)

**Table-I. Gender distribution. Number of patients-41.**

Refractive Error	Number of Patients (%)
Hypermetropia	29 (70.73%)
Myopia	12 (29.26%)

**Table-II. Refractive error. Number of patients-41.**

Visual Acuity Groups	Number of Patients (%)
6/24	14 (34.14%)
6/36	8 (19.51%)
6/60	10 (24.39%)
CF	9 (21.95%)

**Table-III. Pretreatment V.A groups. Number of patients-41.**

Visual Acuity	Number of Patients
6/6	7 (50%)
6/9	3 (21.42%)
6/12	4 (28.57%)
6/18	0 (0%)
6/24	0 (0%)
6/36	0 (0%)
6/60	0 (0%)
CF	0 (0%)

**Table-IV. Post treatment results of VA 6/24 group. Number of patients. 14.**

Visual Acuity	Number of Patients
6/6	3 (37.5%)
6/9	3 (37.5%)
6/12	1 (12.5%)
6/18	1 (12.5%)
6/24	0 (0%)
6/36	0 (0%)
6/60	0 (0%)
CF	0 (0%)

**Table-V. Post treatment results of VA 6/36 group. Number of patients. 8.**

Visual Acuity	Number of Patients
6/6	0 (0%)
6/9	0 (0%)
6/12	2 (20%)
6/18	6 (60%)
6/24	1 (10%)
6/36	0 (0%)
6/60	1 (10%)
CF	0 (0%)

**Table-VI. Post treatment results of VA 6/60 group. Number of patients. 10.**

Visual Acuity	Number of Patients
6/6	0 (0%)
6/9	0 (0%)
6/12	0 (0%)
6/18	0 (0%)
6/24	3 (33.33%)
6/36	0 (0%)
6/60	4 (44.44%)
CF	2 (22.22%)

**Table-VII. Post treatment results of VA CF group. Number of patients. 9.**

Visual Acuity	Number of Patients	%age
6/6	10 (24.39%)	
6/9	6 (14.63%)	
6/12	7 (17.07%)	
6/18	7 (17.07%)	
6/24	4 (9.75%)	
6/36	0 (0%)	
6/60	5 (12.19%)	
CF	2 (4.87%)	

**Table-VIII. Post treatment cumulative results. Number of patients. 41.**

## DISCUSSION

Active visual therapy (AVT) with patching is the gold standard treatment of anisometropic amblyopia. Our study shows accountable results with AVT in the treatment of anisometropic amblyopia as reflected in results table. Results mainly depends on severity of amblyopia, age of patients and compliance of therapy. Tables-IV and V mentioning VA 6/24 and 6/36 with less severe amblyopia demonstrate accountable outcome as compared to severe amblyopia as shown in Tables-VI and VII. In more dense amblyopia in

our patients with pretreatment visual acuity of counting finger 22.2% patients have shown no improvement. Multiple national and international studies have been carried out on this issue with variable results but all studies favour patching of dominant eye with AVT of amblyopic eye to be the best one. The national and international results variations are mainly AVT duration, age of patient's degree and depth of amblyopia and compliance of treatment. In our study the AVT time was 3 hours per day at the dose of one week per year of age while literature review shows AVT duration of 2 -6 hours daily in various studies.

Reversal of anisometropic amblyopia is possible if during the sensitive period of visual development proper visual stimulus is provided. Several randomized controlled clinical studies have elicited the results of patching and AVT duration.

PEDIG Trial of 6 hours, full time occlusion have shown improvement of various degree in amblyopic therapy<sup>14</sup> and the results depend upon the severity of amblyopia.<sup>18</sup>

PRDIG has shown 3.6 lines improvement in amblyopia with 2 hours patching while in our study 3 hours patching was done with AVT.<sup>19</sup>

Wallace DK, Laizar EL, study recommends that if improvement in visual acuity stops with 2 hours patching then duration should be increased to 8 hours patching and that will improve the visual acuity.<sup>20</sup>

Singh et al have reported significant differences between patching and patching with AVT. The only patching has shown 1.8 line improvement while patching with AVT has shown improvement of 2.4 lines supporting our study.<sup>21</sup>

Carlos J Hernandez Rodriguez et al in their randomized control trial has reported promising results of AVT patching in anisometropic amblyopia.<sup>22</sup>

The treatment outcomes mainly depend upon age of the patient refractive error and compliance of patients. Poor compliance with treatment

increases the risk of treatment failure. Oliver et al and Chen et al have found younger amblyopic more compliant than older amblyopic and show good results with therapy.<sup>23,24</sup>

Lithander J, Sjostrand have reported that compliance influences the outcome of therapy very much and with good compliance resolution of amblyopia is 95% as compared to poor compliance in which resolution of amblyopia is 50%.<sup>25</sup>

S. S Toor et al have reported in their study the age, degree of anisometropia, depth of amblyopia, treatment modality and compliance of treatment were the major factors responsible for success and failure in management of anisometropic amblyopia.<sup>26</sup>

## CONCLUSION

Anisometropic amblyopia is a quite treatable ocular morbidity particularly when patching of dominant eye is augmented with active visual therapy of the amblyopic eye. The reversal of amblyopia is co-related with many factors. Age of the patient and severity of amblyopia are important factors which direct effect on reversal. Early age and less severe amblyopia have good results with patching and active visual therapy. Compliance of treatment is also important factor in reversal of amblyopia. Good compliance is necessary for fruitful results.



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