

## Efficacy of Worth 4 Dot Test and Vertical prism dissociation Test in Screening of Amblyopia among School Going Children.

Javeria Jamshed<sup>1</sup>, Ammara Affi<sup>2</sup>, Ayesha Maham<sup>3</sup>, Hafsa Noor<sup>4</sup>, Aimal Rasheed<sup>5</sup>,  
The University of Faisalabad, Faisalabad<sup>1-5</sup>.

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### ABSTRACT

**Purpose:** To assess the efficacy of Worth 4 dot test and Vertical prism dissociation test in screening of amblyopia in School going children and to screen the prevalence of amblyopia.

**Methods:** After ethical approval this descriptive cross-sectional study was conducted from September, 2020 to July, 2021 at three Government Schools of Faisalabad, Pakistan. Non-probability random sampling technique was used to screen out 400 subjects. All subjects were equally screened out with the help of Vertical Prism Dissociation Test (VPDT) and Worth 4 Dot (W4D) test. Data was analysed through chi-square and cross tabulation by using SPSS software version 20. Both VPD test and W4D test were performed in which fixation pattern and suppression were documented on self-designed proforma. Data was entered and analysed in SPSS.

**Results:** There was a good agreement between qualitative measures of fixation pattern with VPDT and suppression with W4DT for the clinical determination of amblyopia ( $p < 0.005$ ).

**Conclusion:** This study concluded that the prevalence of amblyopia was 8% in school going children and there was significant relationship in success rates and reliability of vertical prism dissociation test and worth four dot test in screening of amblyopia ( $p = 0.00$ ).

**Keywords:** Amblyopia, Visual Acuity, Suppression, Screening.

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### INTRODUCTION

Amblyopia is defined as a decrease in vision during early years of life due to insufficient visual experiences. Clinically, it is reduced visual acuity along with some common factors that may lead to amblyopia such as anisometropia, high refractive error, and minor degree of squint.<sup>1</sup> It is a derivative of the Greek word means dull vision, in which ambly means dull and ops means eye.<sup>2</sup>

Amblyopia is a monocular vision loss and is less commonly binocular. It occurs usually because of abnormal visual inputs received by the eye during a critical period of development but it is also the time during which amblyopia can be recovered by using different treatment therapies such as patching or penalization.<sup>3</sup> Refractive amblyopia is the unequal refractive status in both eyes of the patient. When an eye has a greater need for glasses and is left uncorrected for a long time the brain does not learn to see appropriately and suppress the functions of that eye as compared to the eye with less need of correction.<sup>4</sup>

**Correspondence:** Javeria Jamshed  
The University of Faisalabad, Faisalabad.  
**Email:** javeriajamshed24@gmail.com

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The worldwide prevalence of amblyopia was 3% to 5% approximately. The world health organization estimated that children have age <15 are almost 19 million visually impaired in which 12 million individuals had uncorrected refractive errors and amblyopia.<sup>5</sup> Unilateral amblyopia is a developmental vision defect. In some cases patient suffer from both anisometropic and strabismic amblyopia simultaneously.<sup>6</sup> In routine eye examination many objective tests are used to diagnose amblyopia in children, who are too uncooperative with subjective testing, in these most of them assess the fixation behaviour to predict amblyopia.<sup>7</sup>

Fixation preference test measures the monocular visual function when a patient is viewing binocularly, the base down prism is placed over the eye and checks fixation behaviour of both eyes. In this test we compare the fixation of eyes as compared to others to evaluate whether the child prefers fixing with one eye or another or equally using both eyes. A child without amblyopia shows no preference in fixation.<sup>8</sup> This test is also named as vertical prism dissociation test or induced tropia test which is a useful test for diagnosing amblyopia in children without manifest deviation or small-angle (<10 $\Delta$ ) tropia and in whom a definitive visual acuity assessment is difficult.<sup>9</sup>

Suppression plays important role in amblyopic eyes and the most commonly used test to assess suppression is worth 4 dot test which has potential clinical benefit.<sup>10</sup> On worth 4 dot test patients with impaired BSV mostly see two or three dots represent the suppression of either eye while five dots are indicative of diplopia.<sup>11</sup> In the recent study this test was performed in pre-school children.<sup>12</sup>

The present study was designed to assess the efficacy of worth four dot test and vertical prism dissociation test in diagnosing amblyopia. Additionally, efforts were also made to determine prevalence of amblyopia in school going children. Rationale of Study is to evaluate the undiagnosed cases of amblyopia for the sake of early treatment that will be directly helpful for the community.

## METHODS

Ethical approval of this study was obtained vide number TUF/IRB/024/2021. This descriptive cross-sectional

study included 400 children, who fell in inclusion criteria for screening of amblyopia through vertical prism dissociation test and worth 4 dot test. It was conducted in three Government schools; Govt. Girls High school Bhatta colony at Sargodha road, Govt. Boys High school JB Dhanola and Govt. Girls High school kanak basti Faisalabad, Pakistan from September, 2020 to July, 2021 in a time period of 9 months.

The research included both male & female participants with the age range of 3-12 years. Children with congenital conditions such as Retinopathy of prematurity, retinitis pigmentosa, congenital cataract, congenital glaucoma, nystagmus and ocular trauma were abandoned.

Registered consent was taken from patients and test procedures were explained. Data was collected on a self-design proforma. Data collection was started from history taking of individuals including personal history, ocular history and systemic history. After that pen torch light examination was done to rule out anterior segment pathology and to examine ocular adnexa's like eyelids, eyelashes, cornea, conjunctiva and sclera. Direct ophthalmoscopy was done in order to check fundus abnormalities.

Visual acuity of all students was taken with the help of a Log MAR chart at 4 meters distance. Both monocular visual acuity and binocular visual acuity were obtained. Objective refraction was done in order to obtain best corrected visual acuity with the help of retinoscope and trial lenses on children who require refraction. After that researchers did a cover-uncover test to assess strabismus.

At the end of examination, a vertical prism dissociation test and worth 4 dot test was performed one by one on every student to screen for amblyopia. Both Tests were performed at near (33cm) and distance (6 meters) when the participant wore his or her refractive correction.

Data was analysed with SPSS Software version 20. Cross tabulation and chi-square tests were applied on our qualitative data to assess efficacy of vertical prism dissociation and worth four dot test for amblyopia screening in children.

## RESULTS

Total 400 subjects were screened for amblyopia with worth four dot test and vertical prism dissociation test, 255 (64.00% subjects were female and 145 (36.00% subjects were male, including age ranging from 3-12 years (means age 7-2 years. Responses recorded with Worth four dot test showed, n = 351 with Normal binocular single vision (88.00%, n = 14 with Left suppression, n = 13 with Right suppression and n = 22 with Alternate suppression. Responses recorded with Vertical prism dissociation test showed, n = 373 with Normal fixation preference, n = 11 fixate with left eye only, n = 16 fixate with right eye only.

**Tabel- 1: Results of Worth Four Dot Test**

Participants	WORTH 4 DOT TEST				Total	Pearson Chi-Square	
	Normal BSV	Left Suppression	Right Suppression	Alternate Suppression			
	Count	Count	Count	Count	Count	Chi-squared	p-value
Non-Amblyopic	349	0	1	18	368	714.838 <sup>a</sup>	.000
Amblyopic	2	14	12	4	32	179.118	.000

**Tabel-2: Shows Results of Vertical Prism Dissociation Test**

Participants	Vertical Prism Dissociation Test			Total	Pearson Chi-Square	
	Normal Fixation Preference	Fixation With Left Eye	Fixation With Right Eye			
	Count	Count	Count	Count	Chi-squared	p-value
Non-Amblyopic	364	2	4	370	624.031 <sup>a</sup>	.000
Amblyopic	9	9	12	30	122.566	.000

## DISCUSSION

The objective of our study was to assess the efficacy of vertical prism dissociation test and worth four dot test for screening of amblyopia and to screen out the prevalence of amblyopia in school going children. Students of refractive error (hypermetropia, astigmatism and anisometropia) are at high risk of having amblyopia.<sup>13</sup> Our study was conducted in three government schools of boys and girls. We performed these both tests on 400 participants. Our participants had an age range of 3 to 12 years. Because our aim was to assess the prevalence of amblyopia at early age in school going children for early prevention of visual loss. In this study we consider both genders.

Prevalence of amblyopia risk factor in 1836 months of

children was 9.3% (42 out of 453) and 76% (26 out of 34 children). They conclude that automated screening tools help us to diagnose children at an early age.<sup>14</sup> The results of our study showed that amblyopia is common in school going children. Our study reported that prevalence of amblyopia was 8% in a total sample of 400. And the prevalence of amblyopia was more in females as compared to males. The school vision screening with a proper follow-up treatment results in successful outcomes in children that are at risk of amblyopia or other visual abnormalities.<sup>15</sup>

Guimaraes S and co-workers were conducted a cohort study to evaluate effectiveness of amblyopia screening in school going children. This study conclude that screening of amblyopia at the age of 3-4 year is highly effective and effectiveness of treatment on newly diagnose amblyopia was 88%.<sup>16</sup>

A study conducted by Wallace DK<sup>17</sup> to perform different fixation preference tests to confirm amblyopia. This study supported our research topic. As results were reporting that induced tropia test (ITT) was significant in non-strabismic children and monocular fixation preference was significant when deviation of greater than 10 prism dioptre was present. No difference was observed between 10 prism dioptre and 20 prism dioptre fixation tests in assessing amblyopia.<sup>9</sup> This test was performed on 400 participants. In total 31 amblyopic patients 8 patients were unable to respond to vertical prism dissociation test.

Babu and his co-worker<sup>18</sup> observed good agreement between the Bagolini test and the worth four dot test in measurement of suppression. Worth four dot test is the most commonly used test to assess suppression. Another study was conducted at Wenzhou medical university to check intraocular suppression in amblyopic children. In this study the total sample was 49 in which 29 were amblyopic who all responded to W4DT. The worth four dot test was performed at both near and distance to assess suppression. They concluded that worth four dot test was reliable and convenient for measurement of intraocular suppression. In our study we performed this test on total 400 participants in which 31 participants were amblyopic. In total amblyopic patients only 6 patients

were unable to respond W4DT. The results of our study also showed the reliability of worth four dot test.<sup>19</sup>

Management of amblyopia at an early age helps children to provide a better visual outcome. . The amblyopic treatment should be monitored. By concluding it, a good compliance with prescribed treatment of amblyopia was essential for a successful visual outcome. Amblyopic treatment therapies always taper down and not stop immediately after recovery because it may reverse after withdrawal and must have a regular follow up after recovery.<sup>20</sup>

Physicians must have a healthy discussion with the parents of the patient as well as the child itself, about the pros and cons of treatment and should plan a conventional management strategy to deal with amblyopia in older children with newly diagnosed amblyopia.<sup>21</sup>

Study was conducted at a few schools on restricted population so the results cannot be generalized on whole population. Provincial or national level school survey should be conducted to gather concrete data to propose valid recommendations.

## CONCLUSION

There was a good agreement between qualitative measures of fixation preference with vertical prism dissociation test and measures of suppression with worth four dot test. Amblyopia is common in age 3-12 years and can cause visual impairment that can persist throughout life. But it can be prevented by screening for amblyopia and treatment at an early age to achieve good visual outcomes.

**Conflict of Interest:** None to declare

**Author Contributions:** Javeria Jamshed: Concept, Design, Literature Review, Data Collection

Ammara Affi: Literature & Critical Review, Data Collection

Ayesha Maham: Literature Review, Data Collection & Analysis

Aiza Sajjad: Literature Review, Data Collection

Hafsa Noor: Literature Review, Data Collection & Analysis

Aimel Rasheed: Literature Review, Data Collection

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