

# Effectiveness of Prism Spectacles in Patients with Age Related Macular Degeneration

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## ABSTRACT

**Purpose:** To compare between the use of prism and the spectacles without prism in improving near vision, distance vision and quality of life in patients with AMD.

**Study Design:** Randomized control trial.

**Place and Duration of Study:** Al-Shifa Trust Eye Hospital, from October 2021 to April 2022.

**Methods:** Eighty-eight patients with AMD were selected and 44 patients were included in intervention group and control group each. Both interventional and control groups underwent Visual acuity (VA) for distance and near. VF-25 questionnaire was filled to evaluate quality of life (VFQoL). After prescribing prisms and simple glasses without prisms, both groups were called for a follow-up after one week and one month. VF-25 questionnaire was filled again. IBM SPSS was used for statistics. Categorical variables were presented by the frequencies and percentages. Continuous variables were presented by mean and standard deviation.

**Results:** There were 63.64% males. Mean age of subjects was 67.28 + 8.0. A repeated measure ANOVA determined that mean VA for distance, near (for single opto-type and continuous text) and quality of life of intervention group and control group increased from pre-intervention to one month ( $p < .0005$ ), and from pre-intervention to one week ( $p = <0.001$ ), but not from one week to one month ( $p = >0.005$ ). Mean improvement in near and distance vision was significant better in intervention group than the control group ( $p = < 0.001$ ).

**Conclusion:** There was statistically significant improvement in near, distance vision and quality of life with the use of prism in AMD.

**Key Words:** Prism, Age related macular degeneration, Visual acuity.

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## INTRODUCTION

Age related macular degeneration (AMD) results in central loss of vision. The activities of daily life and face recognition becomes difficult. This may happen slowly over several years or quickly within a week or a month. Genetic and environmental factors may be involved in AMD.<sup>1</sup> Smoking and lack of anti-oxidants are the most common non-genetic factors.<sup>2</sup> Although

there is advancement in medical sciences, the AMD management has some restrictions and patients are often advised to visit low vision rehabilitation center to use their residual functional vision. The loss of vision for both dry and wet forms of disease is central visual deprivation as it affects the macula. This central visual deprivation causes reading problems which can be managed by magnifying glasses or different types of magnifiers. The central vision loss due to ARMD has a severe effect on patient daily routine life.<sup>3,4</sup>

Although there are many surgical and medical interventions that can slow the progress of the disease but once the loss of function has been occurred it cannot be reversed. However, there are many methods like magnification with microscopes and telescopes to

enlarge the smaller objects, use of large print materials (relative size magnification) and guidance to the patients to use eccentric viewing (functionally creating a new central area using peripheral retina), thereby taking the scotoma out of direct gaze<sup>5</sup> This does not restore the vision of macula but optimize visual acuity on the best remaining portion of the retina.<sup>6</sup>

Prisms glasses are also used as a low vision rehabilitation device to use peripheral vision. The theory of use of prism in AMD is based on the fact that it diverges the course of light and changes its direction. On the other hand, prisms are also used as a substitute to provide magnification in low vision rehabilitation clinics. However, the benefits of prism glasses depend on patient’s co-operation and participation.<sup>7,8</sup>

This study was conducted to find out the effectiveness of using prism in improving vision and quality of life in our setup.

**METHODS**

A randomized clinical trial study (Clinical Trial Registration #NCT05437302) was carried out from October 2021 to April 2022 at the low vision rehabilitation center of a tertiary care eye hospital in Rawalpindi, Pakistan named Al-Shifa Trust Eye Hospital.

The participants were divided into interventional group (who were given prisms in both eyes to match with patients’ desired power and base direction) and the control group (who were given glasses of equal thickness and weight to prism spectacles but without prisms).

The glasses dispensed to each group included best refractive correction distance and near vision. The study group was included to determine whether a prescription of average prism spectacles might be as effective as a dispensing of custom prism spectacles.

Participants were selected through simple random technique. Patients visiting Low vision department with AMD were included. They were allotted identity numbers. Total 250 patients visited low vision department in 3 months. Only 171 patients fulfilled our inclusion criteria. With systematic randomization 88 AMD patients (sample size) were randomly selected.

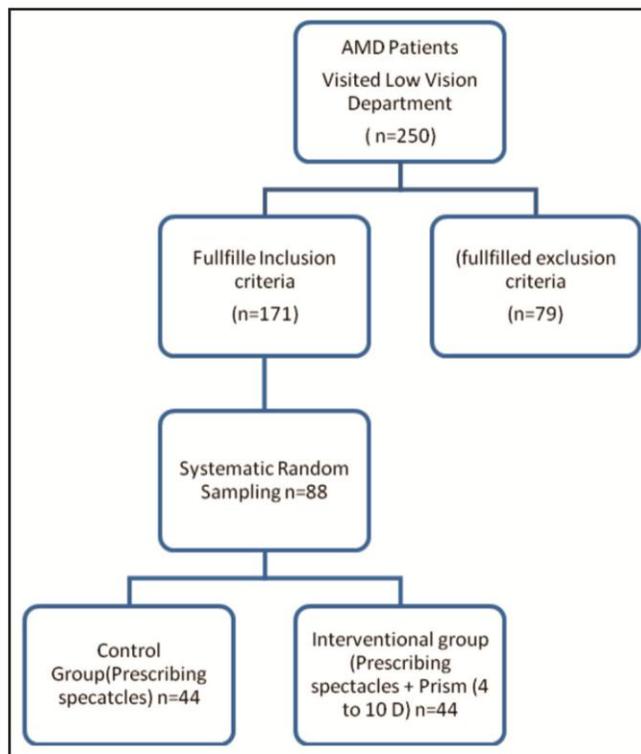
$K = 171/80 = 1.94$  approximately 2. Every second AMD patient was selected. Then according to the

ratio, 1:1, 44 patients were included in intervention group and 44 were in the control group randomly.

Patients of both gender with age related macular degeneration, age  $\geq 50$  years constituted the study population. Patients who had other ocular pathologies that caused visual impairment, eye conditions causing choroidal neovascularization other than AMD, previous laser photocoagulation, and not willingness to participate were excluded. The study was conducted after taking approval from the university ethical review committee (TUF/IRB/058/2022).

Self-structured Proforma and questionnaire were used for data collection. Twenty-five National Eye Institutes Visual Functioning Questionnaire was used to create this self-structured proforma. Tool were validated by subject expert and reliability was checked by Crohn’s back alpha value after pilot study in ten percent of sample size. Crohn’s back alpha value has found 0.78.

Subjects (diagnosed patients with age related



**Flow Diagram of Sampling**

macular degeneration) for the trial of prism spectacle were recruited in Low Vision Clinic at Light House Department according to the inclusion criteria. Both

interventional and control groups underwent same procedure for low vision assessment. The selected cases were informed about the details of study. The risks and benefits of the study were explained to them and after taking informed consent, low vision assessment included history about social demographic questions like age, gender, education, occupation, marital status, number of children, any other systemic disease and use of medication.

Visual acuity (VA) for distance was taken at 4 meters and ETDRS chart was used. It was calculated in Log MAR units. VA for near was taken with Light House near vision chart at 20 to 30 centimeter used and calculated in M units. Near vision was also calculated by continuous text chart in Urdu language to check crowding phenomenon. Subjects were then evaluated for prism correction. Patients those showed improvement on the acuity task or in clinical impression were given prism prescription. The prism power was ranged from 6 prism diopters to 10 prism diopters.

Near acuity was recorded at an appropriate distance (30 – 40 cm) with the habitual add in place using Log MAR near vision chart. The near prism correction was determined by placing the prism correction for near vision in trial frame. A VF-25 questionnaire was filled to evaluate their quality of life (VFQoL).<sup>9</sup>

After prescribing prisms and simple glasses without prisms, both groups were called for a follow-up appointment after one week and then after 30 days. They were asked to complete VF-25 questionnaire again. The data was entered in IBM SPSS statistics for Windows, Version 26.0. Descriptive analysis was done. Categorical variables were presented by the frequencies and percentages. Continuous variables were presented by mean and standard deviation.

Normality of dependent variables was assessed and data was found normally distributed.

Mean, Median and 5% trimmed mean were found approximately same for the distance vision, Single optotype near vision and Continuous text near vision (Table 1).

## RESULTS

In current study, there were 63.64% males. Mean age of subjects was 67.28±8.0. Mean age of control group was 65.5 years and that of intervention group was 67.5 years.

A repeated measure ANOVA with a Greenhouse-Geisser correction determined that mean BCVA (Best corrected visual acuity) of intervention group and control group differed significantly between follow ups ( $F(2) = 796.6, P < 0.001$ ) and ( $F(2) = 394.6, P < 0.001$ ) respectively. Post hoc analysis with a Bonferroni adjustment revealed that BCVA significantly increased from pre-intervention to one month ( $p < .0005$ ), and from pre-intervention to one week ( $p < 0.001$ ), but not from one week to one month ( $p > 0.005$ ) in both groups. (Table: 1).

Similarly mean near vision (for single opto-type and continuous text) of intervention and control groups differed significantly between follow-ups ( $P < 0.001$ ). Post hoc analysis with a Bonferroni adjustment revealed that near vision significantly increased from pre-intervention to one month ( $p < .0005$ ), from pre-intervention to one week ( $p < 0.001$ ), but not from one week to one month ( $p > 0.005$ ) for control and intervention groups (Table 2 and 3).

Mean total score of quality of life of intervention group and control group differed significantly between follow ups ( $P < 0.001$ ), pre-intervention to one month

**Table 1:** Repeated measure ANOVA for the Comparison of distance vision between three levels.

BCVA	Control Mean ± SD	p-value	Effect size	Interventional Mean ± SD	p-value	Effect Size
Baseline	0.87 + 0.09	< 0.001	0.94	0.91 + 0.07	< 0.001	0.90
After one week	0.47 + 0.11	< 0.001		0.65 + 0.10	< 0.001	
After one month	0.47 + 0.11	< 0.001		0.65 + 0.10	< 0.001	

**Table 2:** Comparison of Near Vision between Three Levels in Control Group And Interventional Group.

Near Vision (SOPT)	Control Mean ± SD	p-value	Effect Size	Interventional Mean ± SD	p-value	Effect Size
Baseline	3.17 ± 0.56	< 0.001	0.98	3.6 ± 0.45	< 0.001	0.86
After one week	1.83 ± 0.49			1.33 ± 0.28		
After one month	1.83 ± 0.49			1.33 ± 0.28		

**Table 3 Comparison of continuous text between three levels in control group and interventional group**

Near Vision (Continuous Text)	Control Mean ± SD	p-value	Effect Size	Intervention Mean ± SD	p-value	Effect Size
Baseline	15.95 ± 1.9	< 0.001	0.90	16.5 ± 1.9	< 0.001	0.487
After one week	14.40 ± 2.4			10.4 ± 1.90		
After one month	14.40 ± 2.4			10.4 ± 1.9		

**Table 4: Comparison of VFQOL between three levels in control group and interventional group.**

Quality of Life	Control Mean ± SD	p-value	Effect Size	Intervention Mean ± SD	p-value	Effect Size
Baseline	38.2 ± 5.20	< 0.001	0.453	36.6 ± 2.50	< 0.001	0.566
After one week	34.0 ± 4.2			38.06 ± 3.05		
After one month	30.9 ± 3.1			39.7 ± 3.08		

**Table 5: Improvement in Vision and Quality of Life between Control and Interventional Groups.**

Improvement	Interventional	Control	MD	p-value
In Distance vision	0.24 ± 0.9	0.4 ± 0.09	0.15	< 0.001
In Near Vision (Single Optotype)	5.9 ± 1.28	2.4 ± 1.64	3.5	< 0.001
In Near Vision (Continuous text)	2.29 ± 0.26	1.62 ± 0.46	0.67	< 0.001
In Quality of life	3.11 ± 3.4	5.7 ± 8.2	8.89	< 0.001

( $p < .0005$ ), from pre-intervention to one week ( $p = < 0.001$ ), and not from one week to one month ( $p = > 0.005$ ) (Table 4).

Independent unpaired sample t test was applied to check the comparison of improvement in near vision (single optotype and continuous text), distance vision and quality of life (QOL) between interventional and control group. Preliminary analysis was done to assess the normality of base line quality of life. Mean median modes were found same. Homogeneity of variance as assessed by Levene's Test for Equality of Variances. It was found that the mean of improvement in near and distance vision was statistically significant in intervention group than the control group ( $p = < 0.001$ ) (Table 5).

## DISCUSSION

The current study showed that vision and quality of life significantly improved in both groups. However, it was even better in the prism group. The use of prism dispensed in glasses consist of comparatively low power of sphere and prism. It is always advised to prescribe binocular prisms to prevent diplopia.<sup>10</sup>

Studies have shown that chances depression increase with poor vision.<sup>11,12</sup>

There is evidence of better fixation with prism when used for image translocation towards peripheral retina in AMD.<sup>13</sup>

Literature shows a new trend towards intraocular implantation of prisms within the capsular bag after phacoemulsification.<sup>14</sup>

Contrary to our results, Smith et al compared three groups for AMD visual rehabilitation. They found that Prism spectacles were no more effective than conventional spectacles in patients with AMD.<sup>15</sup>

In another study, the distance VA was significantly improved with the use of prism spectacles than distance glasses without prism.<sup>16</sup> Another supporting evidence to current study was a clinical trial in which, 12 months follow up was done. At first follow up of 3 month, a statistically significant change in VA was noted in experimental group in comparison to control group. Moreover, at 6 and 12 month follow ups, there was gradual increase in improvement, while no VA improvement was seen in control group.<sup>17</sup> Similarly the current study followed up the patients after one week and then at 1 month and found significant results of much improved vision along with improved quality of life in treatment group participants than that of control. Use of prism avoids macular translocation which improves vision by 360 degrees Retinectomy for AMD.<sup>18</sup> Following macular translocation, improved reading speed had been documented as well.

Some studies did work to determine the low vision quality of life (LVQOL) score and found increasing score in patients wearing prism spectacles regularly

and 17% increased score after rehabilitation. The highest improvement was seen in fine motor skills and reading.<sup>19</sup> In addition to this, it has been seen that AMD raised the chances of fractures, falls and limitations in the life. However, these risk can be reduced by use of prism.<sup>20</sup>

With all these advantages, there are limitations to the use of prism as well, especially with high power prisms. They are associated with dizziness, discomfort and pain.

Strength of this study is that it gauges quality of life in a practical setting. In this sense, the study pioneers the use of “patient related outcome measures” in randomized settings in Pakistan. In order to test prismatic correction in a real-world setting, participants can be requested to share any insights and experience they may have on how prism spectacles may affect their routinely activities and quality of life.

There is a dire need to give awareness to masses about the use of prisms in AMD. Improving the training of health care personnel on the use of prisms. Patients who receive vision rehabilitation can make the most of their residual vision and adjust to daily activities.

## CONCLUSION

There was statistically significant improvement in near vision, distance vision and quality of life with the use of prism in AMD as compared to routine spectacles.

**Conflict of Interest:** Authors declared no conflict of interest.

## Ethical Approval

The study was approved by the Institutional review board/Ethical review board (TUF/IRB/058/2022).

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### **Authors' Designation and Contribution**

Mehreen Tanveer; Optometrist: *Concepts, Design, Literature search, Data acquisition, Data analysis, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.*

Ayesha Kiran; Optometrist: *Data acquisition, Data analysis, Statistical analysis.*

Mahmood Hussain; Associate Professor: *Manuscript editing, Manuscript review.*

Ayesha Rehman; Optometrist: *Manuscript editing, Manuscript review.*

