

# CRITERIA OF PRESCRIBING REFRACTIVE CORRECTION IN MARGINAL REFRACTIVE ERRORS

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### Abstract

**Purpose:** This study investigated the prescribing decisions for marginal refractive correction by Pakistani optometrists and ophthalmologists. **Methodology:** This study took a cross-sectional approach at the prestigious Superior University in Lahore between February and May of 2022. Optometrists and ophthalmologists from Pakistan responded to a self-designed questionnaire via physical and online (e-mail, Google Forms, and WhatsApp) modes of communication. The purpose of this questionnaire was to survey the degree of the refractive error at which participants prescribe correction for varying degrees of refractive error in both the presence and absence of symptoms. **Results:** The study included a total of 120 working professionals as participants. The presence of symptoms was a major factor that influence the prescribing patterns of participants. In the presence of symptoms, most of the practitioners (75%) prescribe correction for every refractive error while in the absence of symptoms, only 25% of participants prescribe correction. But for presbyopia, 50% of practitioners prescribe correction in the presence and absence of symptoms. Other factors like age, receiving incentive on sale, and work environment does not have any influence on the prescribing decisions. **Conclusion:** The presence of symptoms has been found to be the major factor that influences the prescribing decisions of participants. The number of years of experience possessed by the practitioner is another factor that plays a role in prescribing decisions.

**Keywords:** Myopia, Hyperopia, Asitgmatism, Criteria of Prescribing, Refractive correction

### INTRODUCTION

A refractive error (ametropia) is a condition of the eye in which there is an error in the way light is focused by the eye which can result in a reduction in the visual acuity. <sup>(1)</sup> Refractive errors can be caused due to change in the axial length of the eyeball, change in the shape of the cornea or aging of the crystalline lens. <sup>(2)</sup>

Refractive errors, which can be corrected with glasses or contacts, are the most common

type of vision problem that occurs all over the world and can be treated. These are the most common reason for consulting an eye care practitioner which accounts for 21.1% of all outpatient visits. <sup>(3)</sup> the most common reason for impaired vision and blindness all over the world is a refractive error that has not been corrected. There are almost 88.4 million people worldwide having impaired vision due to uncorrected refractive errors. <sup>(4)</sup> Among the elder population (more than 50 years old), a slight decrease in vision can be associated with social, psychological, and physical problems and increased death risk. While in young populations and children, undetected and uncorrected refractive errors can cause behavioral problems and they can affect their school performance and social interaction. <sup>(5)</sup>

Myopia is a type of refractive error in which parallel rays of light come from the infinity focus in front of the retina causing blurred images of distant objects. Diverging lenses are used to correct this error of refraction. <sup>(6)</sup> It is also called short-sightedness or near-sightedness. <sup>(7)</sup> Hypermetropia or farsightedness is a refractive error in which parallel rays of light coming from infinity focus behind the retina and cause blurring of vision while watching near objects. <sup>(8)</sup> It is also called far-sightedness and long-sightedness. It is caused due to the short axial length of the eyeball. It is more common in young children to have a small degree of hypermetropia as their eyeball and axial length grow longer with time. <sup>(9)</sup>

Astigmatism is the refractive condition of the eye in which the refraction of the eye varies in different meridians of the eye and makes different focal lines instead of making one focal image. These two different images overlap and cause blurred distance and near vision. <sup>(10)</sup> In astigmatism, the anterior surface of the cornea or the crystalline lens become irregular which changes the way of passing light into the eye. It is commonly present at the time of birth but it can also cause due to eye injury or as a result of eye surgery. The thinning or scarring of the cornea may increase the risk of developing astigmatism. In younger children, uncorrected astigmatism can cause amblyopia. <sup>(11)</sup>

Presbyopia is a condition of the eye which is caused by a decline in the accommodative function of the crystalline lens of the eye in older age resulting in difficulty seeing near objects. <sup>(12)</sup> It is a normal process of aging and after the age of 40 a person can notice difficulty seeing near objects. Reading glasses (plus lenses) are used to correct presbyopia, which can be bifocals, trifocals, or progressive lenses. <sup>(13)</sup>

Anisometropia is a refractive condition in which there is a difference between the refractive errors of both eyes. It is the second most common cause of amblyopia. <sup>(14)</sup>

Small refractive errors include a group of specific far-sighted refractive conditions which can be compensated by enhanced accommodation and which are not exhibited by the loss of visual acuity. <sup>(15)</sup> Main function of optometrists is to prescribe the correction for refractive errors and to determine in which cases the refractive correction of a patient's refractive errors is required and necessary. <sup>(16)</sup>

Marginal or borderline refractive errors are occurring commonly among younger adults and when they try to compensate for their refractive error by using accommodation, it can cause asthenopic symptoms. The main importance of prescribing correction for small refractive errors is to eliminate the asthenopic symptoms. As accommodation declines with aging, the reason for accepting refractive correction changes during the lifetime. Younger patients prefer refractive correction to prevent asthenopia caused by a small number of refractive errors while older patients prefer refractive correction for improved visual acuity. Although small refractive errors do not decrease the visual acuity significantly they can affect the visual performance of an individual. <sup>(15)</sup>

It is necessary to detect the refractive errors and to correct or treat them because uncorrected refractive errors or improperly corrected refractive errors can lead to the degradation of the contrast sensitivity function and stereopsis. <sup>(17)</sup> To identify any abnormality in visual development, vision screening, and eye examination is effective but when eye examination and vision screening is performed periodically, it is much more effective for timely management and treatment. <sup>(17)</sup>

## **METHODOLOGY**

Ethical clearance from The Superior University Ethics Committee was obtained. A cross-sectional study was conducted from February 2022 to May 2022. Non-Probability Purposive Convenient Sampling Method was used to calculate the sample size according to which 120 participants were included in this study. The population was Optometrists and Ophthalmologists from all over Pakistan. Opticians, ophthalmic technicians, and other medical professionals were excluded. Data was collected by creating a self-designed questionnaire which included demographic questions like age gender and professional questions like work environment, and years of experience. There were other questions about the prescribing behaviors of practitioners in which they were asked to which degree they prescribe correction for different types of refractive errors among different age groups. This questionnaire was filled out by Pakistani optometrists and ophthalmologists through physical and online (E-Mail, Google Forms, WhatsApp) mode.

## **DATA ANALYSIS METHOD**

Data were analyzed by using SPSS (Statistical Package for Social Sciences), version 25. The statistical significance was assessed by using the Mann-Whitney test. To assess the correlation between the years of experience and each question, the Spearman test was applied. 25<sup>th</sup> percentile, 50<sup>th</sup> percentile, and 75<sup>th</sup> percentile were calculated by using the percentile function of Excel. To calculate the cumulative percentage, the frequency of each box was counted for every question.

## RESULTS

**Table 1: Work Environment of Respondents**

WORK ENVIRONMENT	N	Percentage
<b>Workplace</b>		
Hospital	73	60.8%
Private optical store	21	17.5%
Clinic	26	21.7%
<b>Job description</b>		
Optometrist only	86	71.7%
Dispensing only	4	3.3%
Optometrist + dispensing	4	3.3%
Work as Ophthalmologist	26	21.7%
<b>Self-employed or Salaried position</b>		
Self-employed	6	5.0%
Salaried position	114	95.0%
<b>Incentive on Sale (Commission)</b>		
Yes	30	25%
No	90	75%

Table 1 describes that the maximum respondents work in hospitals (60%) only as optometrist. (71.7%) subjects are working in private optical stores and 26 subjects (21.7%) are working in clinics and does not sell any product on which they can receive any incentive (75%). 26 subjects

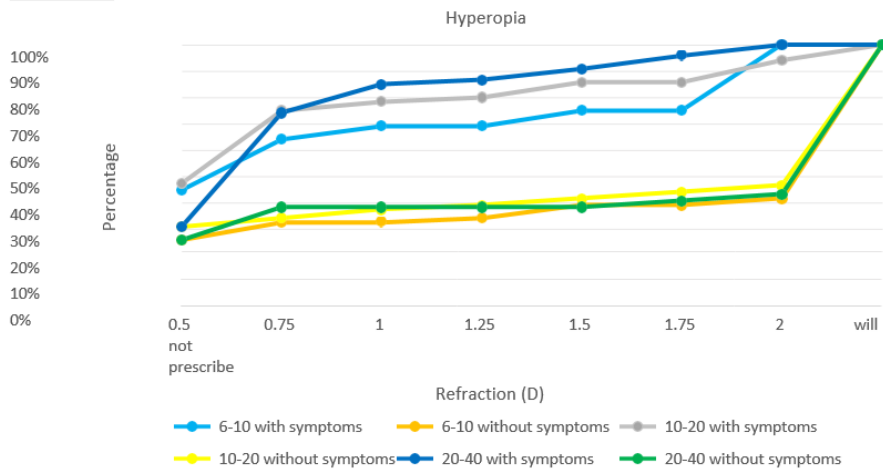
**Table 2: Columns 2-6 give the refractive error at which the proportion of respondents indicated in column 1 would prescribe for the scenario outlined in column 1.**

With/without symptoms and percentile	Aged 6-10 (D)	Aged 10-20 (D)	Aged 20-40 (D)	Aged 40-50 (D)	Aged 50-70 (D)
<b>Hyperopia</b>					
With symptoms 25th percentile	+0.50D	+0.50D	+0.50D	—	—
With symptoms 50th percentile	+0.75D	+0.75D	+0.75D	—	—
With symptoms 75th percentile	+1.75D	+1.00D	+1.00D	—	—
Without symptoms 25th percentile	+0.50D	+0.50D	+0.50D	—	—
Without symptoms 50th percentile	—	—	—	—	—
Without symptoms 75th percentile	—	—	—	—	—
<b>Myopia</b>					
With symptoms 25th percentile	-0.50D	-0.50D	-0.50D	—	—
With symptoms 50th percentile	-0.50D	-0.50D	-0.50D	—	—
With symptoms 75th percentile	-0.75D	-0.50D	-0.75D	—	—
Without symptoms 25th percentile	-0.25D	-0.50D	-0.50D	—	—
Without symptoms 50th percentile	—	—	—	—	—
Without symptoms 75th percentile	—	—	—	—	—
<b>Astigmatism</b>					
With symptoms 25th percentile	0.50D	0.50D	0.50D	—	—
With symptoms 50th percentile	0.50D	0.50D	0.50D	—	—
With symptoms 75th percentile	— 0.50D	0.75D	0.75D	—	—
Without symptoms 25th percentile	—	0.75D	0.50D	—	—
Without symptoms 50th percentile	—	—	—	—	—
Without symptoms 75th percentile	—	—	—	—	—

<b>Presbyopia</b>						
With symptoms 25th percentile	—	—	—	+0.75D	+1.50D	
With symptoms 50th percentile	—	—	—	+1.00D	+2.00D	
With symptoms 75th percentile	—	—	—	+2.00D	+2.50D	
Without symptoms 25th percentile	—	—	—	+2.00D	+2.00D	
Without symptoms 50th percentile	—	—	—	+1.75D	+2.50D	
Without symptoms 75th percentile	—	—	—	—	+2.50D	

Table 2 shows the importance of symptoms in the prescribing behaviours of practitioners in different types of refractive errors.

**Figure 1 (A)**



**Figure 1 (B)**

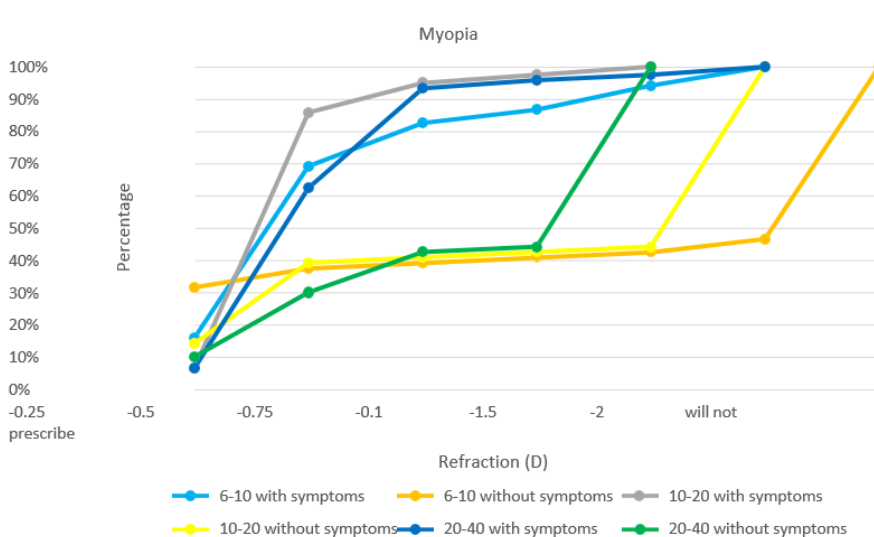


Figure 1 (C)

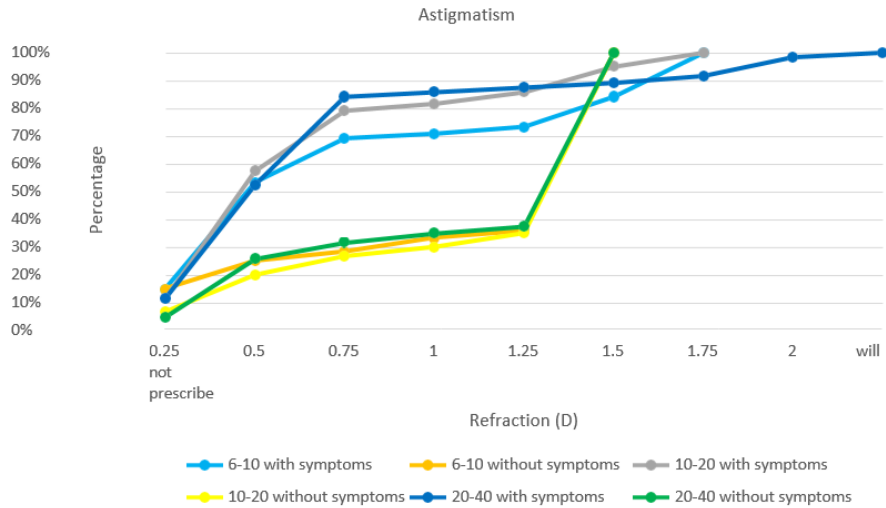
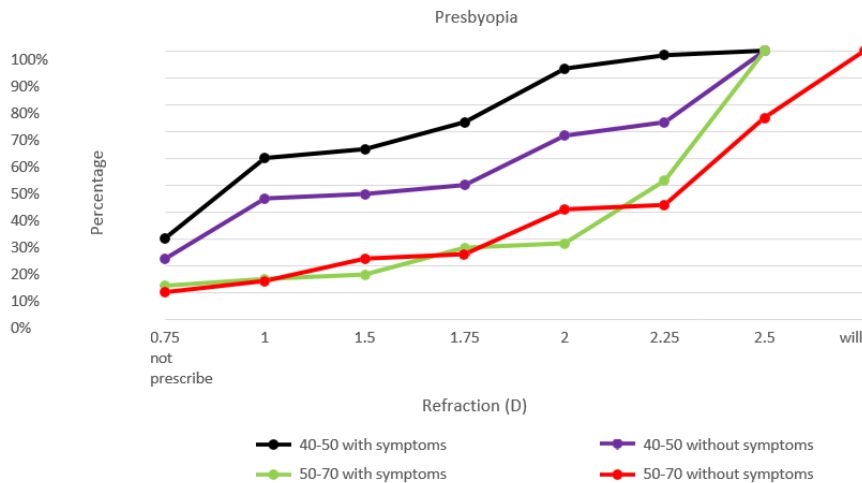


Figure 1 (D)



**Figure 1: the cumulative frequency is plotted as function of the refractive error box for every question.**

(A) Hyperopia, (B) myopia, (C) astigmatism, (D) presbyopia. Age groups with and without symptoms are signified with single colours. (6-10 years with symptoms: light blue, 6-10 years without symptoms: orange, 10-20 years with symptoms: grey, 10-20 years without symptoms: yellow, 20-40 years with symptoms: dark blue, 20-40 years without symptoms: green, 40-50 years with symptoms: black, 40-50 years without symptoms: violet, 50-70 years with symptoms: light green, 50-70 without symptoms: red). The lines connecting data points are showing prescribing decisions of every percentile.

**Table 3: Prescribing behavior as a function of patient age group. Mann-Whitney U statistic and p values between the adjacent age groups are given in the table. (p values are in brackets, \* demonstrates significant value.)**

Age category (years)	6-10 vs. 10-20 U (p)	10-20 vs 20-40 U (p)	40-50 vs 50-70 U (p)
<b>Hyperopia</b>			
With symptoms	1287 (0.71)	871 (0.025*)	
Without symptoms	930 (0.37)	720 (0.002*)	
<b>Myopia</b>			
With symptoms	1280 (0.65)	1334 (0.861)	
Without symptoms	1298 (0.742)	1283 (0.687)	
<b>Astigmatism</b>			
With symptoms	1214 (0.492)	1236 (0.552)	
Without symptoms	858 (0.01*)	1104 (0.891)	
<b>Presbyopia</b>			
With symptoms			724 (0.005*)
Without symptoms			524 (0.00*)

**Table 4: Spearman correlation between years of experience and prescribing behavior in each age group. (p values are in brackets, \* demonstrates significant value.)**

Age group (years)	6-10	10-20	20-40	40-50	50-70
<b>Hyperopia</b>					
With symptoms	0.387 (0.00*)	0.334 (0.00*)	0.050 (0.584)	—	—
Without symptoms	0.267 (0.003*)	0.212 (0.02*)	0.318 (0.00*)	—	—
<b>Myopia</b>					
With symptoms	0.188 (0.039*)	0.236 (0.009*)	0.062 (0.500)	—	—
Without symptoms	0.447 (0.00*)	0.360 (0.000*)	0.285 (0.002*)	—	—
<b>Astigmatism</b>					
With symptoms	0.176 (0.05)	0.201 (0.028*)	0.121 (0.188)	—	—
Without symptoms	0.115 (0.212)	0.126 (0.169)	0.089 (0.332)	—	—
<b>Presbyopia</b>					
With symptoms	—	—	—	-0.222 (0.015*)	-0.312 (0.001*)
Without symptoms	—	—	—	0.022 (0.812)	0.005 (0.995)

In Table 4 a spearman correlation is made between the years of experience of practitioners and prescription at which respondents prescribe correction for different refractive errors in different age group, to check if the years of experience has influence on prescribing behaviour of practitioners.

### **Respondents:**

Maximum respondents who participated in the stud were optometrists (86%) and (26%) were ophthalmologists. maximum respondents work in hospitals (60%) solely as optometrists. (71.7%) subjects were working in private optical stores and 26 subjects (21.7%) were working in clinics and does not sell any product on which they can receive any incentive (75%). 26 subjects (21.7%) were working as ophthalmologists. Only 4 participants (3.3%) were doing dispensing and working as optometrists as well and (3.3%) participants were doing dispensing only. The majority of respondents were working in salaried positions (95%) and only (5%) are self-employed Table 1. These responses were obtained by sending the questionnaire on social media such as what's app groups containing more than 100 or 200 members, posting on Facebook pages and groups, and visiting their workplace.

### **Work Environment and Prescribing Decisions**

To assess whether the working environment has any influence on the prescribing behavior of clinicians, the study population was divided into 2 groups. The ones who receive any commission on sale and the ones who do not receive any incentive on sale Table 1. Because the work environment can affect prescribing behaviors. For example, if someone is receiving an incentive on sale then he can prescribe correction for small refractive errors. But maximum clinicians were not receiving any incentive or bonus on sale.

### **Hyperopia**

In Table 2 importance of symptoms in prescribing behaviors of practitioners is shown. For the degree of hyperopia at which most of the participants (75%) is +1.75D for the age group 6-10 years in the presence of symptoms while in the absence of symptoms (25%) participants prescribe at +0.50. For the age group 10-20 years (75%) prescribe at +1.00D in the presence of symptoms while in the absence of symptoms (25%) prescribe at an error of +0.50D. (75%) give correction at +1.00D for the age group of 20-40 years. Maximum practitioners do not prescribe correction in the absence of symptoms at any age group. In Table 3 there is an increase in the prescribing behaviour from younger age to older age and from without symptoms to with symptoms.

### **Myopia**

Table 2, it has shown a maximum number of clinicians (75%) are prescribing correction of myopia at - 0.75D in the age group 6-10-year-old, -0.50D in 10-20 years old people, and at -0.75D degree of myopia in the presence of symptoms. While in the absence of symptoms (25%) prescribe in the age group of 10-20 and 20-40 years at -0.50D of



myopia. In myopia, prescription criteria were the same in almost all age groups with symptoms Table 3.

### **Astigmatism**

Table 2 demonstrates that the degree of astigmatism at which (75%) prescribe correction is 0.50D among 10-20 years of age group and 0.75D for age group 20-40 years in the presence of symptoms. Without symptoms, maximum practitioners do not prescribe correction at any age group but (25%) of clinicians prescribe a degree of 0.50D of astigmatism among all age groups in the absence of symptoms. Presbyopia

Table 2 it has shown that the criteria for prescribing presbyopia were almost the same in both age groups 40-50 years and 50-70 years in the absence and presence of symptoms by maximum practitioners.

### **Prescribing decisions and years of experience**

To find out the influence of years of experience on prescribing decisions of practitioners, the Spearman correlation was calculated between the power at which practitioners prescribe correction for each question and their years of experience. It was found that there is a positive correlation between hyperopia, and myopia of all ages in the presence of symptoms with years of experience while for myopia and hyperopia in the age group 20-40 there was a positive correlation between prescribing decision and years of experience in the absence of symptoms. For presbyopia, there was a positive correlation in both age groups in the presence of symptoms. Table 4

## **DISCUSSION**

This research has shown that the presence of symptoms is the most important factor that influences the prescribing decisions of Pakistani Optometrists and Ophthalmologists as seen in previous research. <sup>(16)</sup> Most of the practitioners who participated in this study were working in hospitals in salaried positions and those who are working in private optical stores and private clinics do not receive any incentive or commission on sale.

So financial incentive is an insignificant factor in the prescribing decisions of participants. In the previous study, the prescribing decisions for the correction of marginal refractive errors were also not influenced by the commission on sale. <sup>(18)</sup> This study has shown that the age of the participants is a significant factor and prescribing decisions are influenced by the age of patients in myopia hyperopia, astigmatism, and presbyopia.

Clinicians are more likely to prescribe refractive correction for myopia hyperopia and astigmatism among the 10-20 years and 20-40 years age groups while for presbyopia amount of error changes with age so it was age is a significant factor for prescribing correction for presbyopia among patients of 40 years or above. In the previous studies, the age of the patient was important while prescribing correction among young to older patients and teenagers and for presbyopia also but in most of the cases of astigmatism age of the patient was not a factor that influence prescribing decisions. <sup>(18)</sup>

## Hyperopia

In this study, the degree of hyperopic refractive error at 75% of practitioners prescribe correction at the age of 6-10 years is +1.75D, 50% prescribe at +0.75D while 25% of practitioners prescribe correction at +0.50D of hyperopia in the presence of symptoms and in the absence of symptoms only 25% give correction for hyperopia at +0.50D whereas 75% participants do not prescribe correction of hyperopia for this age group in the absence of symptoms. In the previous study at this age group prescription was given at +2.50D degree of hyperopia in the absence and presence of symptoms which is higher than this study. <sup>(19)</sup> For the patients of age 10-20 years, most of the practitioners (75%) prescribe correction at +1.00D while in the absence of symptoms, only 25% prescribe correction at +0.50D of hyperopia. While in a previous study, the degree of hyperopia at which 50% of practitioners prescribe correction was +0.75D in the presence of symptoms and +1.50D in the absence of symptoms for this age group. <sup>(18)</sup> At 20-40 years of age group 75% of participants give a prescription at +1.00D of hyperopia in the presence of symptoms while 25% like to prescribe at +0.50D of hyperopia in the absence of symptoms. While in previous studies 50% of practitioners prescribe correction of hyperopia at +0.75D and do not prescribe correction in the absence of symptoms in this age group. <sup>(16)</sup> In a recent study 50% prescribe at +1.25D in the presence of symptoms and do not prescribe in the absence of symptoms. <sup>(18)</sup>

## Myopia and Astigmatism

In this study, the degree of myopia at which most of the practitioners (75%) prescribe correction is -0.75D for patients of age 6-10 years in the presence of symptoms while in the absence of symptoms, only 25% prescribe correction at -0.25D. For the age group 10-20 (75%) clinicians prescribe correction at -0.50D in the presence of symptoms and in the absence of symptoms only 25% give a prescription at the degree of -0.50D of myopia. In the age group of 20-40 years, the 75<sup>th</sup> percentile was -0.50D in the absence of symptoms while in the absence of symptoms most of the practitioners 75% do not prescribe correction.

In the case of astigmatic error of refraction 75<sup>th</sup> percentile does not prescribe correction in the age group 6-10 years while in 10-20 years and 20-40 years, the degree of astigmatism at which they prescribe in the presence of symptoms was 0.75D. In the absence of symptoms, only 25% of practitioners use to prescribe correction among 10-20 and 20-40 years of age group. In a previous study, 50% prescribe at -0.75D degree of myopia in the presence of symptoms and -0.50D in the absence of symptoms among the age of 4-7 years. <sup>(18)</sup> The previous survey about astigmatic patients and their results are almost the same as this study in the presence of symptoms while in the absence of symptoms, there was a difference of 0.25D for prescribing between this study and the previous study for the 50<sup>th</sup> percentile. <sup>(16)</sup>

## Presbyopia

For the presbyopic patient presence of symptoms does not influence the prescribing behaviors of most practitioners for the age group of 50-70 years but for the age group 40-50 (75%) clinicians do not prescribe in the absence of symptoms. While in previous studies optometrists prescribe lower additions in the absence of symptoms. <sup>(18)</sup>

## CONCLUSION

Criteria of prescribing in cases of marginal refractive error correction by Pakistani optometrists and ophthalmologists were investigated and the presence of symptoms has been found to be a major factor that influences the prescribing decisions of participants. Prescribing decisions are also influenced by the years of experience of the practitioner.

## RECOMMENDATION

In clinical practice, sometimes marginal refractive errors are neglected by the practitioners but they can cause eyestrain, progressive decrease in visual acuity, and affect the quality of life of the patient. It is necessary to detect the refractive errors and to correct or treat them because uncorrected refractive errors or improperly corrected refractive errors can lead to the degradation of the contrast sensitivity function and stereopsis. This study suggests whether to prescribe an optical correction for borderline refractive error or not. If optical correction is thought to be compulsory to provide to the patient then how much refractive error should be corrected?

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