# **Original article:**

# A clinical Study of assessment of visual outcomes in refractive error cases on correction with spectacles

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## Abstract:

**Introduction:** There are some population-based studies on refractive errors from India, but to the best of our knowledge, there is no hospital- or population-based study on refractive errors in 5 to 70 years (children and adults both) of age group reported from central India.

**Methodology:** Records of all the patients who presented at the hospital with visual acuity of 6/9 or less and showed improvement in distance vision of one or more lines with refraction were reviewed.

**Results:** In present study, on evaluating the different types of refractive errors, it was found that most common refractive errors in right eye was simple myopic astigmatism (29.3%) followed by compound myopic astigmatism (27.5%) and compound hypermetropic astigmatism (10.7%). Similarly, in left eye most common refractive errors reported was compound myopic astigmatism (28%) followed by simple myopic astigmatism (22.8%) and simple hypermetropia (17.4%).

Conclusion: Most prevalent refractive error in present study was compound myopic astigmatism.(27.5%)

Keywords: refractive errors, myopic astigmatism ,hypermetropia, myopia

# Introduction:

Refractive error is one of the fastest-growing health issues in the world, and it occurs when a nonaccommodating eye's optical system fails to bring parallel rays of light to focus on the fovea. A mismatch between the eye's axial length and its optical power causes this problem. <sup>1</sup> Refractive errors are categorized into namely myopia,hypermetropia and astigmatism. As refractive error may lead to a loss of education and employment opportunities, lower productivity, and impaired quality of life.<sup>1</sup>So it is an important factor to take action against it as it can affect our daily lives and activities. If refractive problems aren't addressed or the treatment isn't adequate, millions of individuals around the world will suffer, and this is true for both sexes, age groups, and ethnicities. <sup>2</sup> Non-correction of refractive defects is also prevalent in children aged 5–15 due to a lack of screening, to a lack of access to affordable refractive remedies, and to a lack of compliance. <sup>3</sup>

It is a complex and multifactorial condition though any age group can be affected, there is risk of a greater effect on children because they may not complain sufficiently early. <sup>4</sup>Even with extensive literature review, the pattern of refractive errors that is prevalent among young people in India is yet unknown. There are some population-based studies on refractive errors from India, but to the best of our knowledge, there is no hospital- or population-based study on refractive errors in 5 to 70 years (children and adults both) of age group reported from central India. So in this study we will diagnose, measure and get it corrected with spectacles or other refractive corrections to attain normal vision.

**Aims and objective**-To determine the various types of refractive errors in ophthalmic outpatients attending a tertiary care centre and to assess the visual outcomes in refractive error cases on correction with spectacles.

#### Material and methods:

The present observational study provides the hospital-based data on the pattern of refractive errors of patients presenting to the ophthalmology OPD of a Sri Aurobindo institute of medical sciences and postgraduate institute Indore. The study was approved by the Institutional Ethics Committee. This study was a part of our thesis work conducted for last three years. Our sample size was 403 for present study.

## Inclusion criteria

- 1. Patients  $\geq$ 5yrs to  $\leq$ 70 yrs. of age with refractive error  $\geq \pm 0.5D$ .
- 2. Patients without ocular comorbidities.
- 3. Patients who are willing to participate in study.

## **Exclusion criteria**

- 1. Patients not willing for consent for study
- Patients having ocular comorbidities such as any retinopathy,squint,significantcataract,aphakia,pseudophakia.
- 3. Paediatric patients less than 5 yrs.
- 4. Patients more than 70 yrs. of age.

Complete ophthalmic examination and refraction with appropriate cycloplegia for age was done.

The unaided distance visual acuity was determined using a Snellen lettered chart for the literates and the Snellen's tumbling 'E'chart for the illiterate patients at 6m,4m and 1m(counting finger) as the case may be. Records of all the patients who presented at the hospital with visual acuity of 6/9 or less and showed improvement in distance vision of one or more lines with refraction were reviewed. The spherical

equivalent refraction is used with the formula [sphere plus cylinder/2]. Visual acuity converted in logmar scale

#### **Operational definition**

- Ametropia: an eye with refractive error
- **Myopia:** the measured objective refraction is less than or equal to -0.5D spherical equivalent dioptres in one or both eyes
- **Hypermetropia:** the measured objective refraction is more than or equal to +0.5D spherical equivalent dioptres in one or both eyes
- Astigmatism: visually significant if  $\geq \pm 0.5D$
- Anisometropia: it is so called only when the difference in refractive anomalies of the two eyes is greater or equal to + or -2.00D

#### Statistical analysis

IBM SPSS ver. 20 software was used to do the data analysis. The tables were prepared using frequency distribution and cross tabulation. A descriptive analysis was used to ascertain the study cohort's baseline

characteristics. The mean and standard deviation were used to convey quantitative data, whereas numbers and percentages were used to express categorical data

## **Results:**

Type of Refractive Errors	Right Eye		Left Eye	
	Frequency	Percent	Frequency	Percent
Compound Hypermetropic Astigmatism	43	10.7	41	10.2
Compound myopic astigmatism	111	27.5	113	28.0
Mixed Astigmatism	12	3.0	9	2.2
Simple Hypermetropia	29	7.2	70	17.4
Simple Hypermetropic Astigmatism	61	15.1	46	11.4
Simple Myopia	29	7.2	32	7.9
Simple Myopic Astigmatism	118	29.3	92	22.8
Total	403	100.0	403	100.0

Table 1: Distribution according to type of refractive errors

In present study, on evaluating the different types of refractive errors, it was found that most common refractive errors in right eye was simple myopic astigmatism (29.3%) followed by compound myopic astigmatism (27.5%) and compound hypermetropic astigmatism (10.7%). Similarly, in left eye most common refractive errors reported was compound myopic astigmatism (28%) followed by simple myopic astigmatism (22.8%) and simple hypermetropia (17.4%).



Herewith we assessed of visual outcomes in refractive error cases on correction with spectacles.

Type of refractive errors	Age	group								Total
	1-	11-	21-	31-	41-	51-	61-	71-	81-	
	10	20	30	40	50	60	70	80	90	
Compound	1	2	2	2	17	8	6	3	3	43
Hypermetropic										
Astigmatism										
Compound myopic	1	37	29	22	2	8	11	1	0	111
astigmatism										
Mixed Astigmatism	0	0	0	0	0	2	8	2	0	12
Simple Hypermetropia	0	1	8	6	9	2	2	1	0	29
Simple Hypermetropic	2	5	8	3	22	17	1	2	0	61
Astigmatism										
Simple Myopia	2	3	5	1	11	0	8	1	0	29
Simple Myopic	0	10	24	14	4	29	20	13	2	118
Astigmatism										
Total	6	58	76	48	65	66	56	23	5	403

Τ	able	2:	Com	paring	age	distr	ibution	with	type	of	refra	ctive	errors	

Chi-Square Tests						
	Value	df	Asymptotic Significance			
			(2-sided)			
Pearson Chi-Square	232.346 <sup>a</sup>	48	<0.001			
Likelihood Ratio	235.138	48	<0.001			
N of Valid Cases	403					
a. 35 cells (55.6%) have expected count less than 5. The minimum expected count is .15.						

In present study, on evaluating age distribution with type of refractive errors it was observed that in 11-20 years and 21-30 years, most common refractive errors were compound myopic astigmatism. In age group 31-40 years, most common were compound myopic astigmatism and simple myopic astigmatism. In the age group of 41-50 years, most common refractive error were simple hypermetropic astigmatism and compound hypermetropic astigmatism. In 51-60 years, most common refractive error was simple myopic astigmatism. In 61-70 years, most common refractive error was simple myopic astigmatism. The distribution of types of refractive errors and age group was highly significant with p value of <0.001.



Table 3: C	omparing set	x distribution	with type	of refractive	errors
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Type of refractive errors	SEX	Total	
	Female	Male	
Compound Hypermetropic Astigmatism	23	20	43
Compound myopic astigmatism	34	77	111
Mixed Astigmatism	3	9	12
Simple Hypermetropia	20	9	29
Simple Hypermetropic Astigmatism	25	36	61
Simple Myopia	6	23	29
Simple Myopic Astigmatism	53	65	118
Total	164	239	403

Chi-Square Tests						
	Value	df	Asymptotic Significance			
			(2-sided)			
Pearson Chi-Square	24.085 <sup>a</sup>	6	0.001			
Likelihood Ratio	24.540	6	< 0.001			
N of Valid Cases	403					
a. 1 cells (7.1%) have expected count less than 5. The minimum expected count is 4.88.						

In present study, on comparing sex distribution with type of refractive errors it was found that in male and female, most common refractive error was simple myopic astigmatism. Second most common refractive errors in male and female was compound myopic astigmatism and simple hypermetropic astigmatism, respectively. Male were having higher number of refractive errors compared to female suggesting higher prevalence in male. The distribution of sex with types of refractive errors was highly significant with p value of 0.001.



Table 4: Comparing mean VA (logmar) with type of refractive errors

Type of Refractive Errors	Logmar RE	Logmar LE
Compound Hypermetropic Astigmatism	0.5391	0.4921
Compound myopic astigmatism	0.7560	0.7284
Mixed Astigmatism	0.5750	0.5250
Simple Hypermetropia	0.1572	0.1676
Simple Hypermetropic Astigmatism	0.1436	0.0715
Simple Myopia	0.2659	0.4638
Simple Myopic Astigmatism	0.3917	0.3763
Total	0.4498	0.4352
P value	< 0.001	< 0.001

In the present study, on comparing mean VA (logmar) with type of refractive errors it was found that mean VA (logmar) in right eye (p<0.001)was highest in compound myopic astigmatism, similarly in left eye(p<0.001) it was highest in compound myopic astigmatism. Mean VA (logmar)in right eye and left eye were lowest in simple hypermetropic astigmatism respectively.



# Table 5: Comparing Cycloplegic Used with type of refractive errors

Type Of Refractive Errors	Cycloplegic	Total		
	Cyclogyl	None	Triocyl plus	
Compound Hypermetropic Astigmatism	2	9	32	43
Compound myopic astigmatism	19	10	82	111
Mixed Astigmatism	0	12	0	12
Simple Hypermetropia	0	17	12	29
Simple Hypermetropic Astigmatism	7	12	42	61
Simple Myopia	0	11	18	29
Simple Myopic Astigmatism	4	52	62	118
	32	123	248	403

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	91.818 <sup>a</sup>	12	.000
Likelihood Ratio	100.060	12	.000
N of Valid Cases	403		

On comparing the cycloplegic used with type of refractive errors it was found that cyclogyl use was maximum with compound myopic astigmatism. In 123 patients, no cycloplegic was used. Triocyl plus was maximum used in compound myopic astigmatism.

Type of Refractive Errors	Spherical Equivalent RE	Spherical Equivalent LE
Compound Hypermetropic	1.59884	1.27314
Astigmatism		
Compound myopic astigmatism	-3.13495	-2.74797
Mixed Astigmatism	.37500	.21875
Simple Hypermetropia	.62931	.82724
Simple Hypermetropic Astigmatism	.28279	.40984
Simple Myopia	1.05172	1.01724
Simple Myopic Astigmatism	55966	19703
Total	68181	47746
P value	< 0.001	<0.001

Table 6: Comparing mean Spherical Equivalent with type of refractive errors

On comparing the mean spherical equivalent with type of refractive errors it was found that mean spherical equivalent reading was highest in right eye (p<0.001) and left eye(p<0.001)with compound hypermetropic astigmatism. It was lowest right eye with compound myopic astigmatism.

Table 7: Comparing mean Glasses Prescribed with type of refractive errors

Type of refractive errors	Glasses Prescribed RE	Glasses Prescribed LE
Compound Hypermetropic Astigmatism	1.59884	1.27326
Compound myopic astigmatism	-3.13955	-2.75027
Mixed Astigmatism	.37500	.21875
Simple Hypermetropia	.62931	.76276
Simple Hypermetropic Astigmatism	.28279	.40984
Simple Myopia	1.22000	1.01724
Simple Myopic Astigmatism	55966	24537
Total	68992	50327
P value	< 0.001	< 0.001

On comparing mean glasses prescribed with type of refractive errors it was revealed that mean glasses prescribed was highest in right eye (p<0.001) and left eye (p<0.001) with compound hypermetropic astigmatism. It was lowest in right eye and left eye with compound myopic astigmatism.

Type of Refractive Errors	Logmar RE BCVA	Logmar LE BCVA
Compound Hypermetropic Astigmatism	.0293	.0209
Compound myopic astigmatism	.0948	.0568
Mixed Astigmatism	.0000	.0000
Simple Hypermetropia	.0000	.0166
Simple Hypermetropic Astigmatism	.0089	.0000
Simple Myopia	.0310	.1379
Simple Myopic Astigmatism	.0990	.0354
Total	.0618	.0394
P value	<0.001	< 0.001

Table 8: Comparing mean BCVA (logmar) with type of refractive errors

On comparing mean BCVA (logmar) with type of refractive errors it was revealed that highest mean BCVA (logmar) in right eye was with simple myopic astigmatism, while in left eye it was observed with simple myopia. Lowest mean BCVA (logmar) in right eye was recorded in mixed astigmatism, simple hypermetropic followed by simple hypermetropic Astigmatism whereas in left eye, lowest BCVA (logmar) was recorded in mixed astigmatism, simple hypermetropic astigmatism followed by simple hypermetropia.



#### **Discussion:**

Refractive error is a significant and established public health problem. Therefore, it is pertinent for the primary care physicians to know the magnitude and type of refractive errors in the community. <sup>5</sup> Squint and amblyopia can result because of uncorrected refractive error which are difficult to treat once developed. Hence, it is important for early detection and treatment. Uncorrected refractive error can leads to loss of interest in studies

by the students. Working and elderly people also require needs of refractive error correction. This in turn may lead to economic losses, loss of education and lower quality of life. <sup>6</sup>The prevalence of refractive errors generally vary among the different population due to differences in their genetic background and diverse environmental factors

In present study, on evaluating the different types of refractive errors, it was found that most common refractive errors in right eye was simple myopic astigmatism (29.3%) followed by compound myopic astigmatism (27.5%) and compound hypermetropic astigmatism (10.7%). Similarly, in left eye most common refractive errors reported was compound myopic astigmatism (28%) followed by simple myopic astigmatism (22.8%) and simple hypermetropia (17.4%).

Whereas Majumder et al noted 78.40% patients to have positive Refractive Errors.<sup>7</sup>Majumder et al found that among the maximum percentage 21.40 %, (214 out of 1,000) of patients were having Emmetropia, followed by 30.20 %, (302 out of 1,000) were having Combined Myopia and Astigmatism,19.50 % (195 out of 1,000) were having Myopia, 4.6 %, (46 out of 1,000) were having Hypermetropia, 5.8% (58out of 1,000) were having Combined Hypermetropia and Astigmatism and 18.50 % and (185 out of 1,000) were having only Astigmatism.<sup>7</sup>VinodDhiman et al noted thatamong all types of refractive error, astigmatism was most common refractive error(Right eye 47.1% and Left eye 47.7%) followed by myopia and hypermetropia.<sup>8</sup>

Similar to our study, studies done by Qureshi et al <sup>9</sup>and Tuladharet al<sup>10</sup> showed that myopia was most common refractive error. It may be because being a tertiary level hospital; most of the patients who came here were either inadequately corrected or referred from primary or secondary care centres. Therefore, myopic or hypermetropic eyes were less in number as compared to eyes with astigmatism, as that can easily be corrected at peripheral hospitals. Studies done by.Mohammed et al found that Hyperopia was the most common single diagnosis (53.3%) followed by myopia (33.3%). Astigmatism was uncommon as a single diagnosis (13.4%) but commonly associated with hyperopia or myopia.<sup>12</sup>

In present study, on evaluating age distribution with type of refractive errors it was observed that in 11-20 years and 21-30 years, most common refractive errors were compound myopic astigmatism. Whereas in 61-70 years, most common refractive error was simple myopic astigmatism. The distribution of types of refractive errors and age group was highly significant with p value of <0.001.

Vinod Dhiman et al showed that maximum patients were in age group 10- 14 years (23.9%) followed by 15- 19 years (20.9%) age group.<sup>8</sup> He noted that the highest group of was between 16-45 years of age. Mittal S et al found the average age of presentation of children with refractive error was  $10.90\pm3.16$  years.<sup>11</sup> Mohammed et al showed that age groups most affected by refractive errors were 13–18 years (27.7%), 19–24 years (24.8%), and 25–30 years (24.6%), respectively.<sup>12</sup>

In present study, on comparing sex distribution with type of refractive errors it was found that in male and female, most common refractive error was simple myopic astigmatism. Second most common refractive errors in male and female was compound myopic astigmatism and simple hypermetropic astigmatism, respectively. Male were having higher number of refractive errors compared to female suggesting higher prevalence in male. The distribution of sex with types of refractive errors was highly significant with p value of 0.001.Majumder et al noted that among the affected patients, 344 patients were male and 440 patients were female (M : F = 1 :

1.28). <sup>7</sup>Vinod Dhiman et al found that the mean age of all patients was  $20.13 \pm 8.59$  years and the mean age of male and female was  $19.02 \pm 8.64$  years and  $21.03 \pm 8.45$  years respectively.<sup>9</sup>

In the present study, on comparing mean VA (logmar) with type of refractive errors it was found that mean VA (logmar) in right eye (p<0.001)was highest in compound myopic astigmatism, similarly in left eye(p<0.001) it was highest in compound myopic astigmatism. Mean VA (logmar)in right eye and left eye were lowest in simple hypermetropic astigmatism respectively. On comparing the cycloplegic used with type of refractive errors it was found that cyclogyl use was maximum with compound myopic astigmatism. In 123 patients, no cycloplegic was used. Triocyl plus was maximum used in compound myopic astigmatism.

On comparing the mean spherical equivalent with type of refractive errors it was found that mean spherical equivalent reading was highest in right eye (p<0.001) and left eye(p<0.001)with compound hypermetropic astigmatism. It was lowest right eye with compound myopic astigmatism.

Natung T et al noted that most common refractive error was emmetropia followed by myopia, while least common was high myopia. The progression of different types of refractive errors (in SE) with increase in age.<sup>46</sup>Ipe et al noted thatin spherical deformity corrections, -0.5 to +1D were most commonly used, followed by more than +1D. In cylindrical deformity corrections, <-1D and -0.5 to +1D were used most commonly. Cylindrical deformities made conservative correction.<sup>13</sup>

On comparing mean glasses prescribed with type of refractive errors it was revealed that mean glasses prescribed was highest in right eye (p<0.001) and left eye (p<0.001) with compound hypermetropic astigmatism. It was lowest in right eye and left eye with compound myopic astigmatism. Cumberland PM et al noted that the mean value of spherical equivalent was -0.29D [-0.31, -0.27] with range -23.5D to +13.9D.<sup>14</sup>

On comparing mean BCVA (logmar) with type of refractive errors it was revealed that highest mean BCVA (logmar) in right eye was with simple myopic astigmatism, while in left eye it was observed with simple myopia. Lowest mean BCVA (logmar) in right eye was recorded in mixed astigmatism, simple hypermetropia followed by simple hypermetropic Astigmatism whereas in left eye, lowest BCVA (logmar) was recorded in mixed astigmatism, simple hypermetropic astigmatism followed by simple hypermetropia.

# **Conclusion:**

Most prevalent refractive error in present study was compound myopic astigmatism which was more common in the age group of 21-30 years and 51-60 years, highlighting higher prevalence in that age groups. Male were having higher number of refractive error.Mean glasses prescribed in right eye was -0.69 and in left eye it was - 0.50.

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