



## Original Article

## Effect Of Axis Orientation And Amount Of Astigmatism On Visual Acuity

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**ABSTRACT:**

**AIMS:** The purpose of study was to find out the effect of axis orientation and amount of astigmatism on visual acuity.

**METHODOLOGY:** An informed consent was taken describing the detail of the study and implication; therefore, the subjects were assured of their confidentiality of information and outcome. Sample size was 70 patients. Patients' visual acuity was taken. After that objective refraction was done with retinoscopy technique. At the end subjective refraction of patients was done. And effect of axis orientation of astigmatism (with-the-rule, against-the-rule, or oblique astigmatism) on patient visual acuity was measured.

**RESULTS:** Most of the patients had with the rule astigmatism; they had good visual acuity as compared to against the rule and oblique astigmatism. The amount of against the rule astigmatism was moderate and visual acuity ranges in 22 patients out of 70 was 6/24-6/60. The amount of astigmatism in with the rule astigmatism was mild and visual acuity ranges in 24 patients out of 70 was 6/9-6/12. The amount of oblique astigmatism was severe and visual acuity ranges in 21 patients out of 70 was 6/18-6/24.

**CONCLUSION:** Against the rule astigmatism affect the visual acuity more as compared to with the rule and oblique astigmatism.

## INTRODUCTION:

“Astigmatism comes from Greek origin (“a” meaning absence and “stigma meaning point) It is a refractive anomaly in which the parallel rays of light entering the eye through the refractive medium do not focus on a single point on the retina to give a sharp image of the object.” Astigmatism is classified in many ways but one of the method is based on the association between the two principal meridians – regular, when both principal meridians are at right angles to each other, and irregular, when two principal meridians are not at a 90 degree angle to each other. Regular astigmatism can be divided into 3 types; with-the-rule (>0 to <30 or >150-<180), , against-the-rule (>60 to <120) or oblique (>30-60 or >120 to <150).<sup>1</sup>

Astigmatic refractive error has association with visual acuity both distance and near visual acuity. The impact of axis of astigmatism whether it is with the rule or against the rule or oblique remains a substance of argument.<sup>2</sup> The incidence of astigmatism improved with increasing age: for ages 20 to 39 years,, 40 to 59 years and 60 years and older, , prevalence estimate were 23.1% (95% CI, 21.6%-24.5%), 27.6% (95% CI, 25.8%-29.3%), and 50.1% (95% CI, , 48.2%), correspondingly. The incidence of astigmatism varies little by race / civilization category. In those 60 years and older, , astigmatism was more common among men (54.9%) than among women (46.1%).<sup>3</sup>

Distortion of image is caused by the astigmatism. Because of difference of magnification of two principal meridians, , distortions of retinal images occur due to uncorrected astigmatism. Due to percentage difference in principal meridian, , the distortion of image is about . 3% % per diopter in corrected astigmatism with distortion of retinal image due to unequal spectacle magnification in two principal meridians which characterizes about 1.6%% per diopter cylinder in the correction at the spectacle plane.<sup>4</sup>

In astigmatic patients uncorrected visual acuity and presence of symptoms depend upon the type of astigmatism whether it is with the rule, , against the rule or oblique. In oblique and against the rule astigmatic patients report more blur and asthenopic symptoms as compared to with the rule astigmatism. In against the rule astigmatic patients, , small amount of astigmatic error also causes symptoms of asthenopia even if visual acuity is normal. High prevalence of low magnitude of with the rule and against the rule astigmatism may be related to high prevalence of symptoms of asthenopia.<sup>5</sup>

Astigmatism is a condition in which there is low order aberration but there is oriented nature of blur. In our population, prevalence of astigmatism is 85% % that can easily be corrected with cylindrical lenses. In adults if there is uncorrected astigmatism, it reduces the visual performance. While on the other dand if there is large amount of astigmatism remain uncorrected in childhood may lead to visual

insufficiencies in any meridian that is called meridional amblyopia. Optometrists or the surgeon faces problem when prescribing astigmatic correction by spectacles contact lenses or corneal surgery.<sup>6</sup>

Against the rule, with the rule and oblique astigmatism also effect the depth of discrimination. Depth of discrimination decreases with increasing the degree of astigmatic blur. There are three binocular orientations that disturb the depth perception, mostly with the rule and against the rule having least effect but the oblique astigmatism has great effect on depth perception.<sup>7</sup>

A study conducted to find association with spherical equivalent of astigmatic correction revealed a U-shaped pattern; increased power of every one diopter in astigmatism, , spherical equivalent increased by 0.230 D in hyperopic persons and in myopic person spherical equivalent increased by 0.664 diopter. One diopter-increase in residual astigmatism the spherical equivalent showed 0.376 D myopic shifts in myopic patients and 0.077D in hyperopic shift in hyperopic patients. Generally, cases of high myopia and high hyperopia had with-the-rule astigmatism and mostly emmetropes had against –the –astigmatism. In myopic and hyperopic patients at higher levels of spherical equivalent, with-the-rule remaining astigmatism decreased, while against –the–rule and oblique remaining astigmatism increased.<sup>8</sup>

Another study was conducted to evaluate the frequency of asthenopia and its association with refractive errors. According to this study asthenopic symptoms most commonly related to the astigmatic patients. In school age children recurrent symptom of asthenopia is headache. Asthenopic symptoms are more common in females than males. On the other hand and hyperopic patients having very mild amount of hyperopia may complain of hyperopic symptoms of alternating blur, , loss of attention and fatigue. Similar other complaints are also related with astigmatism and binocular abnormalities.<sup>9</sup>

Mehta et al demonstrated in their study that for the management of high regular and irregular astigmatism with reformed countersunk piggy back lens (MCL) gives healthy visual comfort and tolerance rather than the high cylindrical optical prescription.<sup>10</sup>

According to Lewis P study if patient has moderate amount of astigmatism it should also be corrected, , it gives advantage to patient. We provide off axis cylinder to the patient it improves the peripheral vision if patient has central field constricted.<sup>11</sup>

According to Hiraoka, against the rule myopic astigmatism affects the uncorrected visual acuity more than the simple with the rule myopic astigmatism. Furthermore, uncorrected distance visual acuity also expressively inclined by the cylindrical refractive correction in patients having against the rule myopic astigmatism but not in patients having with the rule astigmatism.<sup>12</sup>



According to another study induced astigmatism in two eyes affects the distance and near visual acuity in log mar charts. Binocular pseudophakic depth perception also decreases with addition of cylinder, although distance visual acuity is worse in simple myopic astigmatic patients as compared to binocular near visual acuity.<sup>13</sup>

A study was done to define the occurrence of amblyopia and its association with refractive errors in adult Australian population. Gender, age or place of birth has no effect on the prevalence of amblyopia. Anisometropia was common in cases of amblyopia as compared to the normal population and patients have visual acuity of less than 6/12. Amblyopia is a major cause of unilateral reduced visual vision in a population having age greater than 40 years. Anisometropia is also common and the amount of anisometropia was greater in the amblyopic patients compared with the normal population. Oblique astigmatism was more common in amblyopic patient compared with the normal population.<sup>14</sup>

## RESULTS:

### Table no 1

visual acuity of right eye vs. type of astigmatism of right eye  
Crosstabulation

		Type of Astigmatism of Right Eye			Total
		WTR	ATR	Oblique	
visual acuity of right eye	6/60	0	1	0	1
	6/36	0	7	3	10
	6/24	1	8	4	13
	6/18	5	2	5	12
	6/12	8	2	6	16
	6/9	10	2	3	15
<b>Total</b>		<b>24</b>	<b>22</b>	<b>21</b>	<b>67</b>

The cross table between visual acuity of right eye versus type of astigmatism of right eye shows that out of 70 patients 24 has with-the-rule astigmatism, 22 has against-the-rule and 21 has oblique astigmatism.

The cross table between type of astigmatism of left eye verses visual acuity of left eye shows that out of 70 patients 24 has with-the-rule, 23 has against-the-rule and 18 has oblique astigmatism.

## CONCLUSION:

In my study sample size was 70 astigmatic patients. According to my study most of the patients have astigmatism ranges between 0.25D to 3.00D. With-the-rule astigmatism was more common. Visual acuity was affected more in against-the-rule astigmatic patients. Patients were feeling blurring of vision and headache and eye pain in against the

rule astigmatism so my results were significant. And the patients having small amount of uncorrected astigmatism were more uncomfortable. The cylindrical correction in the eyeglasses may make the floor appear to tilt, thus to accept the full cylindrical correction was difficult for patients for first time.

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