

## STATUS OF STEREOACUITY IN DIFFERENT DEGREE OF MYOPIA

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### Abstract

**Background:** Myopia (nearsightedness) is a very common condition in which people can't see the object farther away clearly. It occurs when eyeball grows too long from front to back or when there is a problem with the shape of the cornea resulting in headache and eyestrain. **Objectives:** To determine the stereoacuity in different degree of myopia with and without correction. **Methodology:** A comparative cross-sectional study was conducted at the Ophthalmology Department of University of Lahore Teaching Hospital from July 2021 to November 2021 in the duration of 4 month. A total of 80 subjects of age ranges from 20-30 years of either sex was selected by non-probability convenient sampling technique. All the patients fulfill the inclusion criteria and having myopia of varying degree mild myopia from 0.5-2.0 D, moderate myopia from 2.0 D- 6.00D and severe myopia >6.0 D were the part of the study. After obtaining the best corrected visual acuity the stereoacuity was evaluate with TNO stereoacuity test. SPSS version 22 was used to analyzed the result. **Results:** The mean age of the patients was 24.49±2.08. The frequency of female was 71.25% (n=57) and the male was 28.75% (n=23) respectively. Out of 80 subjects there was 58.75% (n=47) patients with mild myopia, 27.5% (n=22) with moderate myopia and only 13.75% (n=11) patients with severe myopia. Paired sample t- test shows a significant association of stereoacuity with and without correction in all degree of myopia. Chi-square test also shows a significant difference among different degree of myopia. **Conclusion:** There was statistically significant difference of stereoacuity among mild, moderate and severe myopia and also shows a significant improvement of stereoacuity with and without correction in all degree of myopia.

**Keywords:** Degree of Myopia, stereoacuity, TNO

### INTRODUCTION

Myopia is defined when parallel light beams from infinity are concentrated in front of the retina in this sort of refractive error<sup>1</sup>. The term Myopia was derived by a Greek scientist Galen (from the two words 'myein' and 'ops' meaning to close and eyes respectively. Far

point in case of myopia is at a finite distance in front of the eye<sup>2</sup>. Accommodation in myopes who are not using correction, is not matured naturally as they do not need to accommodate to visualize near objects clearly<sup>3</sup>.

The World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB) have mentioned refractive error as the second most common cause of blindness (first being cataract)<sup>4</sup>. According to epidemiology of RE, it is estimated that 22.9% of the world population, or 1.893 billion people are affected by myopia worldwide and 170 million people (almost one fifth individuals in the myopes) are specifically affected by severe form of myopia (greater than -6.00 D), that results in conditions like retinal detachment, choroidal neovascularization, glaucoma and macular atrophy etc. giving rise to permanent visual loss<sup>5</sup>. According to regions, East Asia is more prevalent in myopia and is eighty to ninety percent in young individuals. There is moderate level of prevalence of myopia seen in Japan, China and Korea. There is low prevalence of myopia in Australia. The number of patients with myopia is increasing and many myopia patients have disorders in their binocular vision<sup>6</sup>.

Stereopsis also called as three-dimensional sight or the perception of depth. It is the advance visual function and is one of basic component of binocular function which guide us in performing a wide range of tasks<sup>7</sup>. It is not present at birth but is gradually gained with the increasing visual experience after birth. In human being the critical period for stereopsis is round about three months of age, after that it develops very rapidly and becomes mature around eight to twelve months of age, and then there is continued improvement in stereopsis up to three years of age<sup>8</sup>.

Stereoacuity impacts on many aspects of life. It not only helps in recognizing the depth while perceiving the distance, but also supports in recognition of different objects<sup>9</sup>. Visual system requires binocularity in order to gain 3-Dimensional perception and in this way maintaining an exclusive presentation of the object seeing through two eyes<sup>10</sup>.

There are many factors that causes decreased stereoacuity. One of which is the difference of refractive error greater than three diopters between the two eyes, while the other common factor is amblyopia that is a condition in which one or both eyes lose vision in the absence of any ocular pathology<sup>11</sup>. The number of patients with myopia is increasing and many myopia patients have disorders in their binocular vision<sup>12</sup>.

This study highlighted the information regarding stereoacuity in varying degrees of myopia. It also rendered the importance of spectacles correction in different degrees of myopic patients.

## **METHODOLOGY**

A comparative cross-sectional study was conducted at the Ophthalmology Department of University of Lahore Teaching Hospital from July 2021 to November 2021 in the duration of 4 month. A total of 80 subjects of age ranges from 20-30 years of either sex was selected by non-probability convenient sampling technique. Ethical approval was

obtained from the ethical review board of the University of Lahore. All the patients fulfill the inclusion criteria and having myopia of varying degree mild myopia from 0.5-2.0 D, moderate myopia from 2.0 D- 6.00D and severe myopia >6.0 D were the part of the study. A patient with the history of other ocular diseases, amblyopia, strabismus, pseudophakia any other drug history or pathological myopia were excluded from this study.

A verbal and written informed consent were taken from every individual prior to their inclusion in the study. After the informed consent a patient's best corrected visual acuity was taken by snellen's chart both monocularly and binocularly. After the visual acuity measurement objective refraction were performed to determine the degree of myopia. After the objective refraction a subjective refraction was performed to maintain the best corrected visual acuity and prescription was documented. After obtaining the best corrected visual acuity the status of stereopsis was measured with and without spectacles correction. TNO stereoacuity test was used for measuring stereoacuity in varying degrees of myopia with and without spectacles. The TNO test consist of seven plates of random dot stereogram, both the qualitative and quantitative stereopsis can be assessed using red and green goggles through which these plates can be seen stereoscopically at a distance of 40cm. First three plates of TNO test were used for screening purpose to evaluate the gross stereopsis which is the qualitative assessment of the stereopsis. Fourth plate were used to assess the suppression of either eye. For the quantitative assessment of the stereopsis plates five, six and seven was used.

Data was analyzed through SPSS version 22. For comparison between varying degrees of myopia, chi square test was applied and stereoacuity was determine with paired sample t test with and without correction in all degree of myopia.

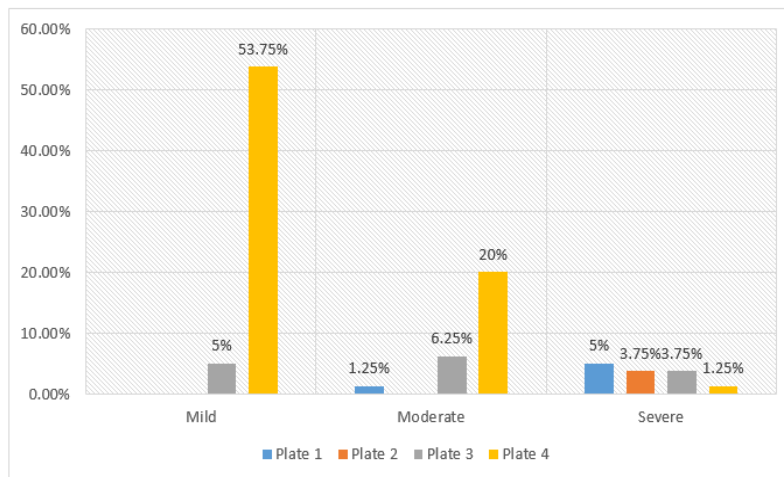
## RESULTS

A total sample was consisting of 80 subjects from age ranges 20-30 year that was selected in this study for qualitative assessment of stereopsis. The mean age of the patients was 24.49±2.08. The frequency of female was 7(71.25%) and the male was 23(28.75%) respectively. Out of 80 subjects there was 47(58.75%) patients with mild myopia, 22(27.5%) with moderate myopia and only 11(13.75%) patients with severe myopia. Out of 23 male patients, 16 patients were with mild myopia, 5 patients were with moderate myopia and only 2 patients were severe myopia. Out of 57 female patients, 31 patients were with mild myopia, 17 patients were with moderate myopia and only 5 patients were with sever myopia (Table1).

**Table1: Gender wise distribution in degree of myopia**

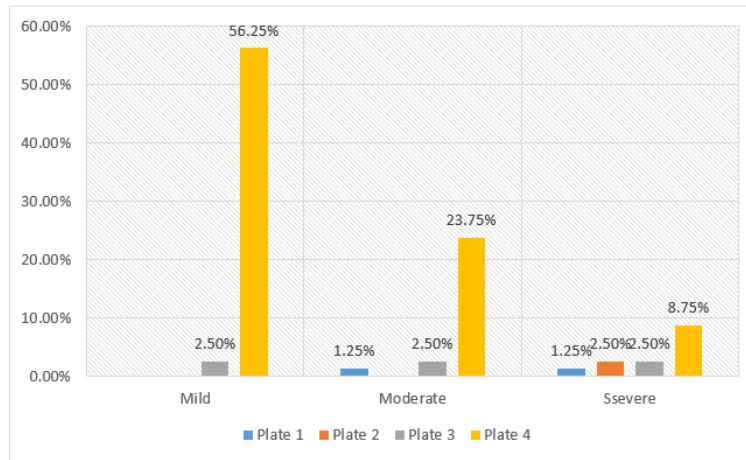
Gender	Degree Of Myopia			Total
	Mild	Moderate	Severe	
<b>Male</b>	16	5	2	23
<b>Female</b>	37	17	3	57
<b>Total</b>	53	22	5	80

On evaluation and analysis of data, out of 47(58.75%) patients of mild myopia, 43(53.75%) patients were able to perceive all the 4 plates of TNO without glasses and 4(5%) were able to perceived first 3 plates of TNO. Out of 22(27.5%) patients with moderate myopia, 16(20%) patients perceived all the 4 plates of TNO, 5(6.25%) were able to perceived first 3 plates of TNO and only 1(1.25%) patient was perceived only 1<sup>st</sup> plate of TNO without glasses. Out of 11(13.75%) patients of severe myopia only 1(1.25%) patient was able to perceived all the 4 plates of TNO, 3(3.75%) patients perceived first 3 plates, 3(3.75%) patients perceived first 2 plates and 4(5%) patients were able to perceived only 1<sup>st</sup> plate of TNO without correction (Fig1). More patients with mild myopia were perceived all the 4 plates of TNO as compared to moderate and severe myopia. The result was significant against the chi-square test value of 0.015.



**Fig 1: Qualitative assessment of stereopsis in different degree of myopia without correction**

Out of 47(58.75%) patients with mild myopia, 45(56.25%) patients were able to perceived all the 4 plates of TNO with glasses and only 2(2.5%) patients were able to perceived first 3 plates of TNO. Out of 22(27.5%) patients with moderate myopia, 19(23.75%) were able to perceived all the 4 plates of TNO and 2(2.5%) patients were able to perceived first 3 plates of TNO and only 1(1.25%) was able to perceived just 1<sup>st</sup> plate of TNO. Out of 11(13.75%) patients with severe myopia, 7(8.75%) were able to perceived all the 4 plates of TNO, 2(2.5%) were able to perceived only first 3 plates and only 1(1.25%) was able to perceived 1<sup>st</sup> plate of TNO with correction (Fig2).



**Fig 2: Qualitative assessment of stereopsis in different degree of myopia with correction**

The mean value of stereopsis without correction in mild myopia was 156sec of arc and with correction was 96sec of arc. The mean value of stereopsis without correction in moderate myopia was 226 sec of arc and with correction was 172 sec of arc. Similarly, the mean value of stereopsis in severe myopia without correction was 286 sec of arc and mean value of stereopsis with correction was 196 sec of arc which is less than the normal value of stereopsis which is 40-60 sec of arc. Paired sample t test shows a significant difference of stereopsis with and without glasses. The stereopsis was significantly improved with glasses in all degree of myopia (Table 2).

**Table 2: Paired sample t test in different degree of myopia with and without correction**

Degree Of Myopia		Mean (Sec of arc)	p-value
<b>Mild Myopia</b>	Without correction	156	<0.001
	With correction	96	
<b>Moderate Myopia</b>	Without correction	226	0.039
	With correction	172	
<b>Severe Myopia</b>	With correction	286	0.024
	Without correction	196	

## DISCUSSION

Stereopsis is a combination of two Greek words stereo and opsia. Words stereo and opsia denote 'solid or three dimensional' and 'appearance or sight' respectively. It is measured in seconds of arc and its normal value is 40 seconds of arc<sup>13</sup>. Symptoms experienced by patients with decreased stereopsis includes perceiving the objects two dimensionally instead of three dimensional. They are unable to appreciate depth of the object. Such patients will not only find difficulty in driving but also in drawing, needle threading, certain

games, walking around corners and painting<sup>14</sup>. The discrepancies of stereopsis in TNO test recorded vary from 480 to 15 seconds<sup>15</sup>.

Zhou et al, conducted a study in the previous year to determine the stereopsis with and without spectacle correction. The result of their study shows that there was a significant improvement (p value = 0.002) in stereopsis after correcting myopic refractive error<sup>16</sup>. The result of this current study also relates with the study conducted by Zhou et al. The result of this current study also shows a significant difference between stereoacuity before and after correction in all degree of myopia.

Akbari and Jafari also carried out a similar study to determine the stereoacuity before and after myopic correction. A baseline stereopsis was evaluated before the myopic error were corrected and after correction of these refractive errors. There was a significant improvement (p value = 0.003) in stereopsis after correcting myopic refractive error<sup>17</sup>. In the current study Stereoacuity before and after correcting the myopia was evaluated. The results of this current study also show a significant improvement in stereoacuity after correction.

Gibaldi et al, also conducted a similar study to investigate the stereoacuity among refractive error. The mean stereoacuity found was  $200.81 \pm 100.97$  in seconds of arc. The stereoacuity in hyperopia, myopia and astigmatism was significantly different (p value= 0.03) before and after correcting the refractive error. Stereoacuity was more effected in hypermetropia, while myopia had comparative better value of stereopsis<sup>18</sup>. In contrast the current study determines the stereoacuity in different degree of myopia and it depicts significant difference of stereoacuity in myopia before and after correction.

Nabie et al, also conducted a similar study to evaluate the stereopsis before and after giving spectacles to the individuals. The findings of their study were consistent with this current study which shows a significant improvement in binocular vision and stereopsis<sup>19</sup>. The current study results were also showing a significant improvement in stereoacuity after correction.

Another study was conducted by Lee et al, to determine the stereoacuity before the patients were given spectacles correction. Mean stereopsis before correction was  $410 \pm 31.6$  arcs per second, while after giving correction stereopsis was measured and mean of it was  $40 \pm 3.5$  seconds of arc. On comparing both there was statically significant (p value = 0.001) results<sup>20</sup>. The current study also shows that there was a significant improvement of stereopsis after giving a spectacle correction.

In contrast to current study another study conducted by Yildiz and Bardak to determine the stereoacuity in different degree of refractive error. The finding of their study shows that there were no statistically significant differences (p value > 0.05) of stereopsis detected in the evaluation in different degree of refractive error<sup>21</sup>. But the result of this current study shows that there was a significant difference of stereopsis in different degree of myopia. The current study determines the stereoacuity in different degree of myopia only. Other refractive errors were not considered in this study. Future study should



be conducted on a larger scale or in different degree of all the refractive error to confirmed the same statement.

## CONCLUSION

There was statistically significant difference of stereoacuity among mild, moderate and severe myopia and also shows a significant improvement of stereoacuity with correction in all degree of myopia. It was concluded that in varying degrees of myopia stereoacuity differs significantly and with correction it got better. Therefore, whatever degree of myopia it may be, it should be corrected as soon as possible.

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