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IMPACT OF MYOPIC AND HYPEROPIC ANISOMETROPIA ON STEREOPSIS AND CONTRAST SENSITIVITY

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ABSTRACT

Background: Anisometropia is a common condition that leads to that visual problem including ARC (abnormal retinal correspondence), aniseikonia, suppression, strabismus and most importantly amblyopia. Aniseikonia causes disturbance in the fusion of two images of both eyes. Due to these problems stereopsis as well as contrast sensitivity is disturbed. Objective: The objectives of the study were to assess the level of stereopsis and contrast sensitivity in myopic and hyperopic anisometropia and also to compare the stereopsis and contrast sensitivity in myopic and hyperopic anisometropia. **Materials and methodology:** A cross-sectional study was carried out in the general OPD of Al-Shifa Trust Eye Hospital, Rawalpindi from July 2021 to December 2021. A study was conducted on 60 patients having anisometropia (myopic and hyperopic anisometropia) up to 2D or greater than 2D to evaluate its effect on stereopsis by using Titmus fly stereo test and contrast sensitivity by using the Mars contrast sensitivity chart. To achieve the objective of the study, data was collected from patients through a structured proforma after taking informed consent. CS was measured by using a Mars Contrast Sensitivity chart. Stereopsis was measured by using a Titmus fly stereo test. **Result:** A total of sixty anisometropic patients were enrolled in this study, out of which 50% were myopic anisometropic and 50% were hyperopic anisometropic. Mean Stereopsis in myopic anisometropic patients was found to be 916.6±1173.5 and in hyperopic

anisometropic were 460±700. The mean CS of myopic anisometropia in RE was 1.40±0.308 and in LE was 1.44±0.32. The mean CS of hyperopic anisometropia in REwas 1.51±0.21 and in LE was 1.53±0.18. There was no statistically significant difference in stereopsis and CS was found in myopic and hyperopic anisometropia with p>0.05. **Conclusion:** There was no statistically significant difference in Stereopsis and Contrast Sensitivity found in myopic and hyperopic anisometropia. CS and stereopsis were affected equally in both types of anisometropia.

KEYWORDS: Impact, Myopia, Hyperopia, Anisometropia, Stereopsis, Contrast Sensitivity.

INTRODUCTION

Anisometropia relates to the differences of refractive power (at least 2 diopters in spherical and cylindrical power) between both eyes which are expected to have deleterious effects on visual function.[1] In Pakistan prevalence of refractive errors is found to be around 8.9% among school children, myopia 78.2%, and Hypermetropia 14.4%. Worldwide, large uncorrected refractive errors are deemed to be the largest cause of moderate and severe visual impairment. Anisometropia presents further challenges in the correction and prevention of amblyopia.[2]

Anisometropia has a strong association with both myopia and hypermetropia, proposing that other mechanisms in addition to excessive eye growth might exist for anisometropia development, particularly in Hyperopia.[3] Hypermetropic anisometropia is believed to be a more huge danger factor for the progression of amblyopia than myopic anisometropia.[13] In the creation of the natural eye, anisometropia is viewed as a causal component in the pathogenesis of amblyopia and strabismus. It is believed that 6 to 38% of all cases of amblyopia are brought about by anisometropia without strabismus, while in around 12 to 18% of the youngsters with strabismus is joined by anisometropia.[6]

The predominance of anisometropia is age-dependent, with a moderately low prevalence (1.6%–4.3%) among young children and a higher prevalence among grown-ups.[3]

Anisometropia is additionally connected with major visual issues including the misalignment of eyes, aniseikonia, BSV, and loss of depth perception.[5,10]

Stereopsis is measured in seconds of arc and normal stereo acuity is 60 seconds. Depth perception is termed as Stereopsis a word derived from the Greek language stereo means

"solid" and opsis mean "sight".[1,4]

Stereopsis is characterized as the relative ordering of visual objects in-depth,and addresses the highest grade of binocular single vision, wherein two unique images of a similar object are formed at a time, on the retina of the two eyes. These images are then processed in the visual cortex to create a single fused image, whose location in space can be seen. The negligible dissimilarity of images detectable by an individual is termed as stereoacuity. Binocular Single Vision, or Stereopsis, is generally completely evolved by six years of age. Stereopsis requires the typical working of two and is adversely affected by refractive errors, anisometropia, aniseikonia, squint and amblyopia for any reason. Binocular depth perception is available just up to six meters distance. [10,11]

Low degree of anisometropia, both spherical and astigmatic, can have possibly huge unfavorable impacts on high-grade binocularinteraction in adults. Foveal suppression, which is directly related to the degree of anisometropia, may be responsible for the loss of stereopsis.[7]

High-Grade anisometropia is connected with the severity of amblyopia and also causes low contrast sensitivity.[5] Visual contrast sensitivity is the ability to recognize an object and the background behind it. Contrast sensitivity is the ability to recognize, separate, or distinguish objects that change somewhat in relative luminance, the difference in contrast sensitivity is due to the differences in sensitivity of retinal ganglion cells.[5,12] Contrast awareness is a key part of visual effects and is capable of performing tasks such as driving, reading, and navigation. The binocular vision deteriorates as the degree of anisometropia rises.[12] The binocular contrast sensitivity function reduces when aniseikonia exceeds 5% and the long term consequence of anisometropia is impaired binocular function.[9] The most widely used devices to test contrast sensitivity is the Pelli Robson contrast sensitivity chart,[14] and Mars Contrast Sensitivity test.

The new Mars letter Contrast Sensitivity test shows excellent agreement with the Pelli-Robson test and has similar repeatability. The Mars test may be a useful alternative to the Pelli-Robson test offering several advantages, including smaller size,improved durability, and ease of use.[15] This study will provide further information to measure Stereopsis and Contrast Sensitivity in myopic and hyperopic anisometropia because early correction of anisometropia of more than 2D is needed in children to prevent the development ofsuppression, Abnormal

Retinal Correspondence (ARC), strabismus, and amblyopia. Early and proper correction of anisometropia can decrease the chances of reduced Stereopsis and Contrast Sensitivity.

MATERIALS AND METHODS

A cross-sectional study was conducted to check the Stereopsis and contrast sensitivity with glasses in myopic and hyperopic anisometropia at the general OPD of Al-Shifa Trust Eye Hospital Rawalpindi. The sampling population included the patients having myopic and hyperopic anisometropia. The sample size was calculated from epi open software, the total sample size was 60 patients using a precision of 3.7 %,[2] margin of error of 5%, and confidence interval of 95%. The inclusion criteria of the study were Patients having anisometropia up to 2D or more was included, Patients having Myopic anisometropia, Patients having Hyperopic anisometropia, and Patients having astigmatic and spherical anisometropia. Exclusion Criteria of the study were those Patients having ocular pathology, Patients having anisometropia lower than 2D, Strabismus, Patients having media opacity, trauma, uncorrected refractive error, nystagmus, Mentally retarded patients, and History of any ocular surgery.

In this study, purely myopic and hyperopic anisometropic (both spherical and cylindrical) patients were included. After taking a complete history, Visual Acuity and refraction were tested using a Snellen visual acuity chart and converted int. Autorefractometer was used to measurerefractive error for reference and confirmed by subjective refraction. Stereopsis was measured by using Titmus Fly stereo test at a 40 cm distance in a well-illuminated room with the patient wearing his/her best refractive correction. Contrast Sensitivity was measured by using a Mars contrast sensitivity test chart at a 50cm distance in a well-illuminated room with the patient wearing his/her best refractive correction. Slit-lamp biomicroscopy was conducted by an ophthalmologist to check anterior and posterior segment diseases. All patients having no posterior and anterior segment pathology were selected, and informed consent and complete ocular history were taken. Data were analyzed using a statistical package for social science (SPSS) version 26.

For inferential statistics independent t-test was applied**.** Age, gender, history of spectacles, refractive status, and types of refractive errors were independent variables. Contrast sensitivity and stereopsis were Dependent Variables.

The study was conducted after the approval of the Hospital Ethical review board. Verbal informed consent was obtained from every single patient included in the study.It was ensured that data collected was used only for academic purposes and confidentiality of the data was ensured.

RESULTS

A total of sixty patients participated in the study. Both the genders were included in the study. The majority of the participants were female N=31(51.7%) while the remaining were male N=29 (48.3%). The mean age of participants was 17.95±5.6, ranging from 10-30 years. All participants included in the study were regularly using spectacles N=60(100%). Out of 60 respondents, N=40(66.7%) had a positive family history of glasses, and N=20(33.3%) had a negative family history of glasses. Visual Acuity was measured with a log MAR the meant. Visual Acuity of the right eye (OD) with spectacle was 0.28±0.27 and that of the left eye (OS) was 0.21±0.26. Among sixty participants N=30(50%) were myopic anisometropic and N=30(50%) were hypermetropic anisometropic as shown in Fig 1.

Major Chief Complaint reported was blur vision by N=42(70%) respondents and N=18(30%) presented with watering, and itching as depicted in Fig 2.

Stereopsis was measured by using the Titmus fly test at 40cm distance in myopic and hyperopic anisometropia. There was no statistically significant difference in stereopsis was found in both types of anisometropia (myopic and hyperopic anisometropia-value p value > 0.05 as in table 2.

And also there was no statistically significant difference of CS found in myopic and hyperopic anisometropia, with p >0.05 as displayed in table 3

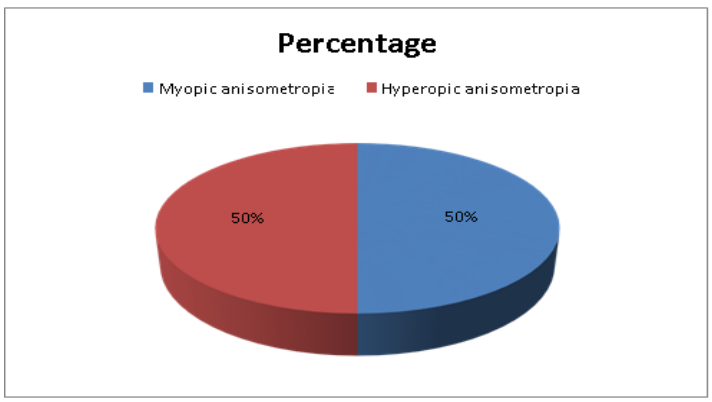

Figure 3: Percentage of types of error.

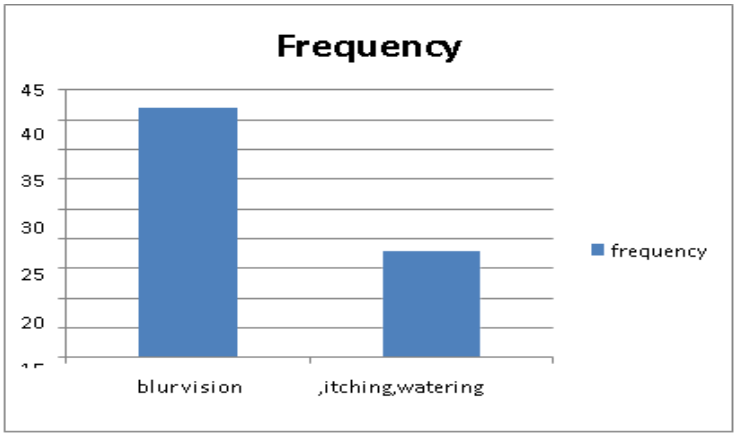

Figure 2: Frequency distribution of chief complains.

Table 1: Mean, standard deviation & p-value of stereopsis in myopic and hyperopic anisometropia.

	Type of error	Mean	ST.deviation	p-value
Stereopsis	Myopic anisometropia	916.6	1173.5	0.073
	Hyperopic anisometropia	460.0	700.04	

Table 2: Mean, standard deviation & P- value of contrast sensitivity in myopic and hyperopic anisometropia.

	Type of error	Mean	Std.deviation	p-value
Contrast sensitivity	Myopic Anisometropia (right eye)	1.4040	0.308	0.09
	Hyperopic Anisometropia(right eye)	1.5187	0.212	
	Myopic Anisometropia (left eye)	1.4453	0.3288	0.18

DISCUSSION

In the present study level of CS and stereopsis was measured in myopic and hyperopic anisometropia. The study revealed that there was no statistical significance difference between groups which shows conflicting results with following study revealed that amongst the pure anisometropic considerably fewer anisohyperopes hold stereo-acuity of 40 sec of arc or better than do anisomyopes. However, some anisomyopes, even with fairly small degrees of myopia in the weak eye show no measurable stereopsis.[16]

According to the study, Contrast sensitivity was affected more in hyperopic anisometropic patients than in myopic anisometropic patients. Mild and moderate myopic patients showed normal contrast sensitivity while severe myopes have reduced contrast sensitivity.[5] Results of the investigation as quoted above were not in the favor of the present study.

Another investigation revealed that hyperopes showed more reduction in contrast sensitivity as compared to myopes. Mild to moderate degrees of myopes and hyperopes showed better contrast sensitivity without any optical correction. Severe degrees of such refractive errors showed decreased contra sensitivity. Binocular contrast sensitivity was much better than monocular contrast sensitivity.[12]Results are not parallel with the present Study . Nabie et al 2019 found that any type of anisometropia may reduce stereoacuity and this reduction is most noticeable with myopic anisometropia, especially in the TNO test.[17] This is in contrast with the present study.

In the study, it was noticed that low levels of anisometropia, both spherical and astigmatic, can have potentially significant adverse effects on high- grade binocular interaction in adults. Foveal suppression, which is directly related to the degree of anisometropia, may be responsible for the loss of stereopsis.[7]

All these studies as mentioned above, are not in the favor of the present study, the reason behind the variations in results was the sample size, the tests charts used for themeasurement of stereopsis, and CS was different in the present study, and the study population was also changed. In the present study, the comparison was checked between myopic and hyperopic anisometropia, but in the studies mentioned above, also comparison of measurements with normal individuals was assessed.

There was no statistically significant difference of stereopsis and CS was found in myopic and hyperopic anisometropia. It was found that stereopsis and CS in both types of anisometropia (myopic and hyperopic anisometropia) was not much different in the present study. CS and stereopsis both were affected equally in myopic and hyperopic anisometropia. As the degree of anisometropia increases, the level of CS and stereopsis decrease.

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