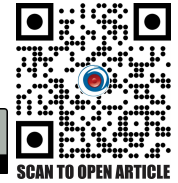# Changes in Level of Steroacuity in Patients Having Different Types of Refractive Errors

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ABSTRACT

Purpose: To find out the frequency of stereoacuity in different refractive errors in patients visiting ophthalmology department of The University of Lahore Teaching Hospital.

Methodology: This was a descriptive cross-sectional study which recruited volunteers visiting department of ophthalmology at University of Lahore teaching hospital. After informed consent, he frequency of steroacuity level in all the participants were assessed using a proforma Steroacuity level was taken as normal (20 seconds of Arc), borderline (20-40 seconds of Arc) and reduced (above 40 seconds of Arc). The depth perception level among the patients of different types of refractive errors (Myopia, Hyperopia and Astigmatism), regardless of gender specific both male and female was examined with the age limit (15-35). SPSS 23was employed for data analysis after the findings were recorded in proforma. Fried-man test was applied to find the statistical significance of data. P-value 0.05 was considered as significant.

Results: A total of 145 people aged (15-35) years old, both genders (male, female) were included in the study. Fifty four (54) myopic participants out of 72, 34 astigmatic out of 55 and 12 hyperopic participants out of 18 had normal stereopsis. Ten (10) from 72 myopia participants, 11 from 55 astigmatism volunteers and 4 out of 18 hyperopic subjects had borderline steroacuity. Likewise, 8 out of 72 myopia patients, 10 out of 55 astigmatism patients and 2 out of 18 had a reduced Stereoacuity above 40 Arc. In overall comparison, 69.0 % were normal, 17.2% were borderline and 13.8% had reduced stereoacuity level with P-value 0.0267.

Conclusion: Our study shows that stereopsis was significantly reduced in those having astigmatism than those with myopia and hyperopia.

Keyword: Stereo-acuity, Binocular Single Vision (BSV), Myopia, Hyperopia, Astigmatism.

INTRODUCTION

Refractive errors are worldwide recognized treatable visual impairment.[1] Refractive errors are not avoidable but can be treatable by using optical corrective eyeglasses, contact lens (CL) and surgery.[2]

The important point to consider about refractive errors as they are the most customary ocular issue that exert influences on an individual of all races, ethnic social class, and age group. According to (WHO) report on errors of refraction are the second source of visual loss all around the World.[2,3]

Hyperopia or far-sightedness is refractive error type in which the axial length of the eyeball is too short the optical image formed is behind the retina. Myopic individuals can be categorized according to the degrees as Mild (- 0.25D - 3.00D), Moderate (-3.00D - 6.00D) and Severe (> -6.00D), which can be further classify as simple (Mild to moderate) and pathological (Severe).[4] Hyperopia is considered to be as a childhood error of refraction. Individuals are hyperopic by birth and on later stages become normal and sometimes myopic.[5] Hyperopia is also classified as Mild (+0.25D±2.75D), Moderate (+2.75D - +5.00D) and severe (> +5.00D). Best corrected visual acuity is used as a basis to fundamentally categorized refractive errors.[6]

Binocular Single Vision is ability of; human eye's corresponding point to fuse with another eye to achieve a single mental impression.[7] Fusion is the second grade of BSV which provide complete composite image with the help of sensory and motor fusion. Stereopsis, 3rd grade of BSV as the impression of depth(3D) from two different angles.[8] The bad stereoscopic vision, associated with the poor vision and with the poor work quality mainly in work which need the coordination of an eye and hand as well as the motor visual skills.[9,10]

Different types of factors are affected by the stereoacuity, such-as the refractive errors (myopia, hyperopia and astigmatism) and the deviation of the visual axis.[11] In various ways, the lack of appreciation of stereopsis has the ability to impact for egg, a potential influence on education.[12] Due to the effect of stereopsis which cause the blurring of vision in eye result in reducing the binocular function as well as with, low sensory fusion.[13] The benefits of using random dot as it is an absolute test of stereopsis which display disparity details in the absence of other depth clues which can be termed as monocular clues, ultimately leads to reliable measure.[14] If at the level of retina the viewing distance increases so, due to increase in distance the size of the image of retina decreases in eyes(both). Commonly at the distance of 40 cm random dot test can be performed.[15]

METHODOLOGY

This was a descriptive cross-sectional study which recruited volunteers visiting department of ophthalmology at University of Lahore teaching hospital. After informed consent, he frequency of steroacuity level in all the participants were assessed using a proforma. Steroacuity level was taken as normal (20 seconds of Arc), borderline (20-40 seconds of Arc) and reduced (above 40 seconds of Arc).The depth perception level among the patients of different types of refractive errors (Myopia, Hyperopia and Astigmatism), regardless of gender specific both male and female was examined with the age limit (15-35). SPSS 23was employed for data analysis after the findings were recorded in proforma. Fried-man test was applied to find the statistical significance of data. P-value 0.05 was considered as significant.

RESULTS

A total of 145 people aged (15-35) years old, both genders (male, female) were included in the study. Fifty four (54) myopic participants out of 72, 34 astigmatic out of 55 and 12 hyperopic participants out of 18 had normal stereopsis. Ten (10) from 72 myopia participants, 11 from 55 astigmatism volunteers and 4 out of 18 hyperopic subjects had borderline steroacuity. Likewise, 8 out of 72 myopia patients, 10 out of 55 astigmatism patients and 2 out of 18 had a reduced Steroacuity above 40 Arc. In overall comparison, 69.0 % were normal, 17.2% were borderline and 13.8% had reduced steroacuity level with P-value 0.0267.

Fried man test was applied to find the significance (P-value=0.03) of data. P-value 0.05 was considered as significant.

Table -1: Frequency of Refractive Errors

Refractive Errors	Frequency	Percentage
Myopia	72	49.7
Astigmatism	55	37.9
Hyperopia	18	12.4
Total	**145**	**100.0**

Table -2: Changes in Stereo Acuity

Stereoacuity	Frequency	Percentage	P- value (Friedman test)
Normal - 20 sec of are	100	69.0	
Borderline- 20-40 sec of are	25	17.2	0.026
Reduced above 40 sec of are	20	13.8	
Total	**145**	**100.0**	

Table -3: Distribution According to Refractive Error

Stereoacuity	Myopia	Astigmatism	Hyperopia	Total
Normal - 20 sec of are	54	34	12	100
Borderline- 20-40 sec of are	10	11	4	25
Reduced above 40 sec of are	8	10	2	20
Total	**72**	**55**	**18**	**145**

DISCUSSION

Stereopsis is visual capability to perceive world around us in 3D depth this allows a people to notice where object is related to them in their surroundings. Binocular disparity is important depth cue in vision which leads to stereopsis and 3D vision. Stereopsis is the highest grade of BSV which is of mandatory importance in many professional fields as well. Proportionate decrease occurs in stereo acuity with the presence of refractive error.[16] But stereopsis can be better by the initial correction of refractive errors, as well as from the surgery which is for turn-eye and through the balancing of binocular vision.[17] Normal stereopsis value is 20 seconds of arc, borderline value of stereopsis is 20-40 seconds of arc and reduced stereopsis value is above 40 sec of arc.[18]

Subramani NNV et al. conducted a study in department of ophthalmology in Chennai medical college. This study was held in 2020 between January & March. The sample size of this study was 150 including both genders. The age group was 19-23 who have refractive errors of myopia that differed to our age range as ours was 15 to 35 and we included different types of refractive error. The distance VA was tested by the use of Snellen chart at the distance of six meters for every subject similar to our study procedure nut in their method VA was recorded before and after refractive errors were corrected in myopia. TNO test was used, instead of the random dot test used in our study. The distance of this test was 0.3mtrs. Red and green goggles were used and stereo acuity was tested. After the correction of myopic refractive errors, the stereoacuity was assessed.[19] Unlike our study random dot test wasn't used to evaluate stereoacuity. By assessing this data, they concluded that the students who had refractive errors of myopia had less stereoacuity before the process of correction. And stereoacuity improved with correction, as our study shows that around 52 myopic subjects from our total of 74 myopic subjects showed normal stereoacuity with their correction. This study supported our results and results were similar to our findings. And this study proved that myopic correction helped in improving stereoacuity.

Mikias MT et al. conducted a study at University of Gondar (TEC) & Training Center, between April 08-June 07, 2019, to find the level of stereo-acuity and few other factors impacting stereoacuity among mature patients having errors of refraction. The study consists of total 153 patients with dissimilar age groups. The number of subjects was closely similar to ours which was 145 but the exception was that there was no age range defined unlike ours which was 15 to 35 years old. Outcomes showed that most of patients had good visual equity and thus stereopsis (66%), like ours in which almost 68% of patients had normal stereopsis. These results also relate to our findings as higher amount of refractive error showed reduced stereoacuity in our results too. Especially in astigmatic and hyperopic subjects.[20]

Research conducted by BMS, Deepa and colleagues demonstrated the assessment of stereoacuity levels using the random dot stereo test at present. Their screening method was similar to ours as they also had used random dot test. A cross sectional study was done among the university

undergraduate medical students. Total 246 participants were involved including male and female of the age group. The sample size was larger than ours compared to our 145 participants results differ greatly as in their research only 13.1% of the students were lie in the normal level of the stereopsis (20 arc seconds) but in our study there were almost 68% of subjects who had normal stereoacuity. Approximately 44.3% were found in their study to lie borderline stereopsis, meanwhile in our study only 17.2% subjects lied in borderline stereopsis. About 42.6% of the population were lie in the reduced stereopsis on the meanwhile on the other hand in our study 13.8% had reduced stereopsis.[21] These results were not relate able to our study there was very noticeable differences in results even though the sample size wasn't so large, this may happen due to the difference in the sample size of our study or patient refractive errors and duration of their study to differ from ours.

CONCLUSION:

Our study shows that stereopsis was significantly reduced in astigmatism than in myopic and hyperopic.

Conflict of Interest: None to declare

Ethical Approval: The study was approved by the Institutional Review Baord / Ethical Review Board No. REC UOL 198.01.2024

Author Contributions: Ambreen Ziarat: Concept, Design, Data Collection.

Hamna Idrees: Literature Review, Data Collection.

Anwar Ul Haq Hashmi: Data Collection and Analysis, Critical Review.

Shanza Dastgir: Literature Review, Data Collection.

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