Acta Scientific Ophthalmology (ISSN: 2582-3191)

Volume 5 Issue 7 July 2022

Research Article

Stereopsis and Color Vision in Children of Al-Ibrahim Eye Hospital, Malir, Karachi

Muhammad Asif Memon[1]*, Samreen Baloch[2], Fazila Shah[2], Ahmed Hafeez[2], Ayaz Ali[2], Kiran[2], Mehak Nazir[3], Muhammad Atif Nisar[4] and Beenish Atif[5]

[1]Isra School of Optometry, Al-Ibrahim Eye Hospital, Karachi, Sindh, Pakistan

[2]Peadiatric Department, Al-Ibrahim Eye Hospital, Karachi

[3]Isra School of Optometry, Al-Ibrahim Eye Hospital, Karachi

[4]Sina Health Clinics, Karachi

[5]Afiya Clinics, DHA, Karachi

***Corresponding Author:** Muhammad Asif Memon, Isra School of Optometry, Al-Ibrahim Eye Hospital, Karachi, Sindh, Pakistan.

Received: June 13, 2022

Published: June 28, 2022

Abstract

Purpose: To determine effect of refractive error and color vision on Stereopsis and evaluate the frequency in children.

Methods: The hospital based; descriptive, cross-sectional study was conducted at paediatric department from July to December 2020.

Results: 29 (51.8%) out of 56 found myopic, 12 (21.4%) hypermetropia and 15 (26.8) astigmatism in right eye and 30 (53.6%) found myopic, 13 (23.2%) hypermetropia and 13 (23.2%) astigmatism in left eye.

21 had normal or 55 sec of arc, 6 have mild 170 sec of arc and only 2 patients had weak 340 sec of arc.12 hypermetropia patient 10 have normal or 55 sec of arc and 2 have mild 170 sec of arc.15 astigmatism patient 6 had normal or 55 sec of arc of stereopsis, 6 have mild 170 sec of arc of stereopsis and 3 patient had weak 340 sec of arc Stereopsis without refractive correction. With refractive correction on Frisby test, 56 (100%) patients had normal or 55 second of arc stereopsis. Out of 56 of patients, 52 (92.9%) patients had normal color vision (Trichromats) and only 4 (7.1%) patients found with blue-yellow color vision defect (Tritan). Tritan color vision anomaly found in 3 females out of 20 and out of 32 male 1 had found with tritan color vision anomaly.

Conclusion: Improvement of stereopsis after correction and no effect of color vision on stereopsis. Tritan (Blue) color vision anomaly was higher in female as compare to male.

Keywords: Stereopsis; Color Vision; Anomaly

Introduction

A feature of perception which is an ability to perceive different wavelengths and classified below [1].

- Monochromats
- Dichromats
- Anomalous trichromats [2].

Stereopsis is the perception of the relative depth of objects is based on the ability to fuse images stimulating disparate retinal elements within Panum's fusional areas [3].

Objectives

- To determine stereo-acuity range in children with different refractive error.

- To determine stereo-acuity range in children in different age group.

Rationale

Normal development of stereopsis is based on binocular single vision and might be disrupted by a number of factors like refractive error, amblyopia and strabismus. This study is aimed to analyses impacts of refractive errors without amblyopia and strabismus on stereopsis in school going children and colors vision defect also affect children in different activities and also affect the child psychologically, so this study also aimed to see the frequency of colors vision defect in school going children.

Material and Methods

Study design

This study was a hospital based; cross sectional study conducted.

Sampling technique

A non-probability, purposive sampling technique was used.

Study setting

Carried out in the low vision clinic.

Duration of study

The duration of study was from July 2021 to December 2021.

Sample size

The sample size was 56.

Data collection instruments

- Snellen visual acuity chart.
- Slit lamp for anterior and posterior segments examination.
- Retinoscope.
- Frisby test.
- Farnsworth-Munsell dichotomous D-15 test.

Research tools

Self-made proforma was used to check the variables.

Sample selection

Inclusion criteria

- Subject with no ocular disease.
- Age 6 to 15.
- VA (With Snellen's Chart) 6/6 and 6/9 with glasses.
- 6/60 without glasses.
- Patient who given consent.

Exclusion criteria

- Mentally ill and uncooperative Subject.
- Age <6 and > 15 years.
- VA (With Snellen's Chart) with glasses >6/9.
- Patient present with any ocular disease.
- Patient who not given consent.

Data collection procedure

We had taken consent verbally and orally by patient or attendant (if the patient is child), all necessary tests related to eye had been examined and Performa fulfil by the help of patient. The steps at paediatric department of initial eye examination include that was Visual acuity (With Snellen Chart), Objective Refraction, Subjective Refraction (Cyclo refraction if needed), Fundoscopy, PMT (Post Mydriatic Test), Frisby stereo test (simplest reliable method of quickly ascertaining stereo acuity), and Farnsworth Munsell dichotomous D-15 test for color vision.

Data analysis procedure

Statistical analysis was done from statistical package for social science (SPSS) version 20.0 All the continuous variables were presented as Mean ± SD and the entire categorical was presented as frequency and percentage.

Ethical consideration

Permission from the patient was taken then formal permission was taken from IRC, IRBC, and ISO after that confidentiality of data was maintained.

Results

A total of 56 patients participated in the study having age ranged from 6 to 16 year (Table 1).

Age	Frequency	Percentage
6-8	9	16.1%
9-10	13	23.2%
11-12	13	23.2%
13-14	14	25.0%
15-16	7	12.5%
Total	56	100%

Table 1: Age distribution.

From total participants 33 (58.9%) were male and 23 (41.1%) were female respectively (Table 2).

Gender	Frequency	Percentage
Male	33	58.9%
Female	23	41.1%
Total	56	100%

Table 2: Gender distribution.

Without refractive correction out of 29 myopic patients, 21 had normal or 55 sec of arc, 6 have mild 170 sec of arc and only 2 patients had weak 340 sec of arc, while out of 12 hypermetropia patient 10 have normal or 55 sec of arc and 2 have mild 170 sec of arc and out of 15 astigmatism patient 6 had normal or 55 sec of arc of stereopsis, 6 have mild 170 sec of arc of stereopsis and 3 patients had weak 340 sec of arc stereopsis. (Table 3).

Stereopsis without glasses	Myopia	Hypermetropia	Astigmatism	Total
Weak 340 sec of arc	2	0	3	5
Mild 170 sec of arc	6	2	6	14
Normal 55 sec of arc	21	10	6	37
Total	29	12	15	56

Table 3: Stereopsis in patient without refractive correction.

Comparison of stereopsis with refractive correction and without refractive and normal stereopsis found in refractive corrective patient with glasses who have reduce stereopsis in without correction (Table 4 and Table 5).

Stereopsis	Frequency	Percentage
55 sec of arc	56	100%
170 sec of arc	0	0%
340 sec of arc	0	0%

Table 4: Stereopsis in patient with refractive correction.

Stereopsis with glasses	340 sec of arc	170 sec of arc	55 sec of arc	Total
55 sec of arc	5	14	37	56
Total	5	14	37	56

Table 5: Comparison of Stereopsis with and without refractive correction.

From the given data of patient 52 (92.9%) patient had normal color vision (Trichromats) and only 4 (7.1%) patients found with blue-yellow color vision defect (Tritan) (Table 6).

Color vision defect	Frequency	Percentage
Trichromats	52	92.9%
Tritan	4	7.1%
Total	56	100%

Table 6: Color vision defect in both eyes.

Tritan color vision anomaly found in 3 females out of 20 patient and out of 32 males 1 had found with tritan color vision anomaly, and tritan color vision anomaly was higher in age group between 13-14 from 6-15 years patients (Table 7 and Table 8).

Color vision defect in both eye	Male	Female	Total
Trichromats	32	20	52
Tritan	1	3	4
Total	33	23	56

Table 7: Color vision defect in both eye genders wise.

Age	Trichromats	Tritan	Total
6-8	9	0	9
9-10	13	0	13
11-12	12	1	13
13-14	11	3	14
15-16	7	0	7
Total	52	4	56

Table 8: Color vision defect in both eye ages wise.

Patient's visual acuity was 6/9 in right 17 (30.4%) and left eyes 18 (32.1%) without refractive correction, out of 56 patient 29 (51.8%) found myopic refractive error in right eye (Table 9 visual

acuity distribution in right eye and left eye), rest of patient found with hypermetropia 12 (21.4%) and astigmatism 15 (26.8) in right eye, out of 56 patient 30 (53.6%) found myopic refractive error, rest of patient found with hypermetropia 13 (23.2%) and astigmatism 13 (23.2%) in the left eye (Table 10 refractive error distribution in right eye and left eye).

Right eye		Left eye	
Vision acuity	**Frequency**	**Vision acuity**	**Frequency**
6/6	05	6/6	03
6/9	17	6/9	18
6/12	10	6/12	12
6/18	04	6/18	03
6/24	04	6/24	05
6/36	06	6/36	08
6/60	10	6/60	07

Table 9: Visual acuity distribution in right eye and left eye.

Right eye			Left eye		
Myopia	**Hypermetropia**	**Astigmatism**	**Myopia**	**Hypermetropia**	**Astigmatism**
29	12	15	30	13	13

Table 10: Refractive error distribution in right eye and left eye.

Discussion and Conclusion

In this study of color vision and stereopsis in children was designed to study the clinical of profile of the subjects with no any ocular pathology and visual acuity 6/6 with best refractive correction from 6-16 years of age group presented in paediatric department of tertiary eye care centre al-Ibrahim eye hospital. Total of 56 subjects was selected from paediatric clinic during study period, out of which 4 patients were found with tritan defect in which 3 were female and1 was male and a previous study was conducted in southern Ethiopia from April 15 to June 20, 2018 where children with any ocular pathology also excluded in whom, out of 35 color blind students were found, 15 had protan and 20 had deutan defect where prevalence of deutan and protan defect were greater in male than female.

In this study Out of 56 patient 29 found myopic refractive error, 12 found with hypermetropia and 15 astigmatisms in right eye. On the left eye Out of 56 patient 30 found myopic refractive error, 13 found with 13 hypermetropia and 13 astigmatisms. A statistically significant correlation between lower visual acuity and color vision was not observed and a previous study was conducted in Iran from October 2013 to January 2014 which showed significant correlation between color vision defect and refractive error.

This current study, stereopsis was assessed with Frisby test which shows that, without refractive correction out of 29 myopic patients, 21 had normal or 55 sec of arc, 6 have mild 170 sec of arc and only 2 patient had weak 340 sec of arc, while out of 12 hypermetropic patient 10 have normal or 55 sec of arc and 6 have mild 170 sec of arc and out of 15 astigmatism patient 37 had normal or 55 sec of arc of stereopsis, 6 have mild 170 sec of arc of stereopsis and 3 patient had weak 340 sec of arc stereopsis, this study shows correlation between stereopsis and refractive error there is study which is done in India in 2014-2015, in which stereopsis was assessed by TNO test, out of 74 participant, 24 were simple myopic, 51 were astigmatism and 65 had anisometropia were associated with a decrease in stereoscopic acuity in the TNO test and there was a significant improvement in stereopsis after correction for refractive errors.

This current study in which 4 patients were found with tritan with normal stereopsis 55 sec of arc means there was no effect of color vision defect on depth perception but there was also study which was done in turkey from April 2015 and January 2017 which showed stereoacuity was significantly better in the control group than in the protanopes and deuteranopes. The study concluded that myopia has a greater effect than other types of refractive error on stereopsis and the stereopsis was good after refractive correction in majority of subjects and this study is also concluded that there was no effect of color vision defect on stereopsis.

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