



CLINICAL STUDY OF THE EFFECT OF THE REFRACTIVE STATUS MYOPIA/ HYPERMETROPIA/ ASTIGMATISM/ EMMETROPIA ON STEREOPSIS IN AGE GROUP 7-35 YEARS AGE

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ABSTRACT **Aim:** To evaluate stereopsis across different age groups (7–35 years) and to assess its association with refractive errors using circle and animal stereopsis tests. **Methodology:** This hospital-based retrospective cross-sectional observational study was conducted at the OPD of Kalyanam Karoti Eye Institute, Mathura, from June to November. A total of 212 participants aged 7–35 years were included after applying inclusion and exclusion criteria. All participants underwent visual acuity assessment using Snellen's chart, detailed refraction, and stereopsis evaluation using circle and animal tests. Data were analyzed for age-wise distribution, refractive status, and stereopsis outcomes. **Results:** Among 212 participants, 53.8% were female and 46.2% were male. The majority (92.2%) were Emmetropic, while myopia (6.3%), Hypermetropia (1.0%), and astigmatism (0.5%) were less common. On the circle stereopsis test, 74.1% demonstrated good stereopsis between 40–60 seconds of arc, while 23.8% showed reduced stereopsis (>80 seconds of arc), and 1.9% had absent stereopsis. The animal stereopsis test revealed preserved gross stereopsis in 94.6% of participants at 100 seconds of arc. Reduced stereopsis was more frequently observed in participants with refractive errors, particularly myopia and astigmatism, compared to Emmetropic individuals. **Conclusion:** Stereopsis was better in younger individual and declined gradually with increasing age. While gross Stereopsis was largely preserved, fine Stereopsis was significantly affected in the presence of refractive errors. The circle test was more sensitive than the animal test in detecting subtle Stereopsis reduction. Routine Stereopsis should be incorporated into comprehensive eye examination for early identification of binocular vision anomalies.

KEYWORDS : 1. Stereopsis, 2. Refractive error, 3. Binocular vision, 4. Circle test, 5. Animal test

INTRODUCTION

Stereopsis is a higher-order visual function that enables depth perception through binocular fusion of slightly disparate retinal images from both eyes. It represents the highest level of binocular vision and is essential for activities such as reading, sports, driving, and hand-eye coordination¹. Normal stereopsis develops in early childhood as biological binocular neural pathways mature and continues to refine into adolescence². Refractive errors including myopia, Hypermetropia, astigmatism, and Anisometropia are among the most common causes of visual impairment worldwide³. Stereopsis is commonly assessed using clinical tools such as the Titmus fly, circle, and animal stereo tests which evaluate both fine and gross stereoscopic function⁴. Fine stereopsis testing is more sensitive in detecting subtle binocular dysfunction associated with refractive errors, even when visual acuity appears normal⁵. Although previous studies have explored stereopsis primarily in children, few have examined its relationship with refractive errors across a wider age spectrum. There is a lack of data correlating specific refractive error types with stereopsis outcomes in adolescents and young adults using commonly employed clinical stereopsis tests. Therefore, the present study aims to evaluate stereopsis in individuals aged 7–35 years and analyze its association with different Refractive error profiles, thereby supporting early detection of binocular vision dysfunction and optimizing refractive management strategies.

Methodology

This is the hospital based retrospective cross-sectional observation study was conducted at OPD Kalyanam Karoti Eye Institute Mathura from 16th June to 30th November. A total of 210 individual age ranged between 7 to 35 years of age were selected.

Study design -

1. Setting - OPD. Of Kalyanam karoti eye institute Mathura UP.
2. Time Period - June to November.
3. Data sources - OPD. Patient of Kalyanam Karoti eye institute

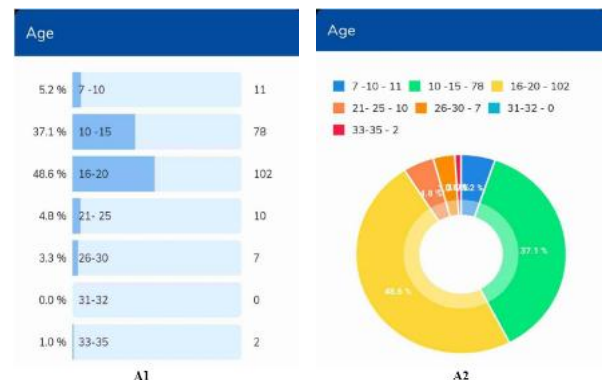
4. Participants -. A total of 210 individual aged 7 to 35 were included of these 53.8% were female and 46.2% men.

5. Inclusion criteria -Individuals who had either vision or any type of refractive were included

6. Exclusion criteria -Exclusion criteria included patients with age below 10 years to age above 35 years Amblyopia, low vision, cataract, glaucoma, ocular allergies, high myopia, high Hypermetropia, high refractive or any other ocular disease.

7. Examination and procedure - After obtaining informed consent form every patient, every patient under gone a standard refraction routine. History taking followed by visual acuity measurement by Snellen chart then we done stereopsis of every patients & recorded data of stereopsis.

RESULT



Graph A1 and A2 shows percentage of various age ranges between 7 years to 35 years.

A total of 212 subjects aged between 7 and 35 years were included in the study. Participants were divided into seven age groups: 7–10(11 patients are there 5.2%) 11–15(78 patients are there 37.1%) 16–20 yrs (102 patients are there 48.6%) 21–25(10 patients are there 4.8%) 26–30(7 patients are there 3.3%) and 31–32 years.(0 patients are there)33–35 (2 patients are there 1%)



Graph B1 and B2 shows that percentage of Gender distribution between male and female... In this study 46.2% were male and 53.8% were female



Graph C1 and C2 shows that...Stereopsis was assessed at a testing distance of 16 inches and expressed in seconds of arc. A total of 212 participants were included in the analysis.

Distribution of Stereopsis Levels

The majority of participants demonstrated

A. Good to moderate stereopsis.

- 1) 40 seconds of arc (considered excellent stereopsis) was observed in 74 subjects (35.4%), representing the largest group.
 - 2) 60 seconds of arc was recorded in 54 subjects (25.8%), indicating good functional stereopsis.
 - 3) 50 seconds of arc was seen in 27 subjects (12.9%).
- Together, 74.1% of participants exhibited stereopsis between 40–60 seconds of arc, suggesting that most individuals in the 10–35 year age group had preserved binocular depth perception.

B. Reduced Stereopsis

A smaller proportion showed reduced stereopsis, possibly associated with refractive errors:

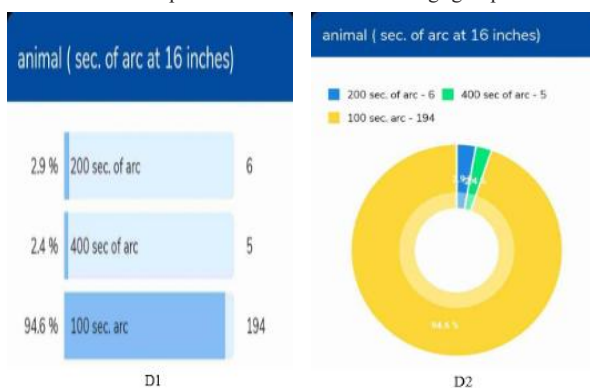
- 1) 80 seconds of arc: 9 subjects (4.3%)
- 2) 100 seconds of arc: 17 subjects (8.1%)
- 3) 140 seconds of arc: 13 subjects (6.2%)
- 4) 200 seconds of arc: 8 subjects (3.8%)
- 5) 400 seconds of arc: 3 subjects (1.4%)

These findings indicate that approximately 23.8% of participants had stereopsis poorer than 60 seconds of arc, reflecting mild to moderate binocular dysfunction, which may be influenced by uncorrected or inadequately corrected refractive errors.

C) Poor or Absent Stereopsis

- 1) No stereopsis was found in 4 subjects (1.9%).
- 2) 800 seconds of arc was not recorded in any participant (0%).

The very low prevalence of absent stereopsis suggests that severe binocular vision impairment is uncommon in this age group.

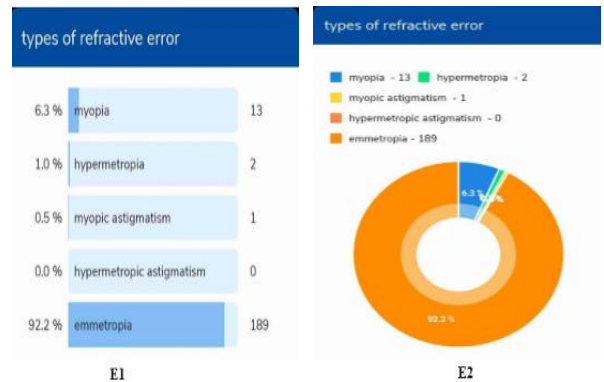


Graph D1 and D2 shows Animal Stereopsis Test. The Animal test demonstrated a high clustering of responses, reflecting assessment of gross stereopsis. 100 seconds of arc was recorded in 94.6% of participants. Reduced stereopsis (200-400 seconds of arc) was found in 5.3% of participants. No participant showed absence of stereopsis

on the Animal test. This indicates that gross stereopsis was largely preserved in this study population.

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Graph E1 and E2 shows that a total of 212 participants were evaluated for refractive status and stereopsis of which 205 responses were valid and 7 were excluded due our exclusion criteria .Distribution of refractive error:

The study population was predominantly emmetropic.

- 1) Emmetropia was observed in 189 participants (92.2%)
- 2) Myopia was present in 13 participants (6.3%)
- 3) Hypermetropia was noted in 2 participants (1.0%)
- 4) Myopic astigmatism was found in 1 participant (0.5%)
- 5) Hypermetropic astigmatism was not observed (0%)

This indicates a low prevalence of refractive errors within the study population, with myopia being the most common refractive error.

Correlation of Refractive Error with Stereopsis Participants with emmetropia demonstrated better stereopsis, predominantly achieving 40-60 seconds of arc on the Circle test and 100 seconds of arc on the Animal test, indicating preserved fine and gross stereopsis. In contrast, participants with refractive errors, particularly myopia and astigmatism, were more frequently associated with:

- 1) Moderate to reduced stereopsis (≥ 80 seconds of arc) on the Circle test
- 2) Higher stereopsis thresholds (200-400 seconds of arc) on the animal test.

Although the number of hypermetropic and astigmatic subjects was small, these participants tended to show poorer stereoscopic performance, likely due to blur, accommodative stress, or binocular imbalance.

The majority of participants was emmetropic (92.2%) and demonstrated good stereopsis. Reduced stereoscopic acuity was more commonly observed among participants with refractive errors, particularly myopia and astigmatism, indicating that the presence of refractive error adversely affects fine stereopsis even when gross stereopsis remains relatively preserved.

DISCUSSION

On the Animal stereopsis test, the majority of participants (94.6%) demonstrated stereopsis of 100 seconds of arc, with only 5.3% showing reduced stereopsis (≥ 200 seconds of arc). The findings suggest preservation of gross stereopsis in most individuals aged 10-35 years, while subtle binocular deficits are better detected using more sensitive stereopsis tests. From this research study it shows that The Animal stereopsis test showed a marked clustering of responses at 100 seconds of arc, indicating that this test predominantly identifies gross to moderate stereopsis rather than fine stereoscopic acuity. Only a small proportion of participants exhibited reduced stereopsis (≥ 200 seconds of arc). The limited variability in stereopsis outcomes suggests

that the Animal test may be less sensitive to subtle binocular dysfunction, particularly in young individuals with mild or corrected refractive errors.

The present study evaluated age-related changes in stereopsis among individuals aged 7–35 years. Better stereoacuity was observed in younger age groups, with a gradual decline noted as age increased. These findings suggest that although stereopsis develops early in life, subtle age-related changes may occur even in young adulthood.

Previous studies have reported optimal stereopsis in childhood and adolescence, with a decline in stereoacuity in later years. The findings of the present study are consistent with earlier literature, reinforcing the importance of binocular vision assessment across all age groups.

From a clinical perspective, routine evaluation of stereopsis can aid in early detection of binocular vision anomalies and help guide appropriate

CONCLUSION

Stereopsis varies significantly across different age groups, with superior stereo acuity observed in younger individuals. Age-related changes in stereopsis highlight the need for routine binocular vision assessment as part of comprehensive eye examinations. This study indicates that while the Animal test is useful for screening, the Circle test is superior for detecting subtle stereopsis reduction associated with refractive errors.

Acknowledgement

Author would like to thank Mr. Sunil Kumar Sharma sir for giving permission to conduct research at Kalyanam Karoti eye institute and thank Ms. Uma Sharma for her valuable assistance in data collection.”

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