Stereopsis in Accommodative Esotropia at Al-Ibrahim Eye Hospital, Karachi, Pakistan

Shua Azam[1]*, Abdul Hameed Talpur[2], Sadia Bukhari[3], Tania Waseem[4], Shehnaz Bhatti[4], Mahnoor Shafique[4] and Safia Nisar[4]

[1]*Assistant Professor, ISRA School of Optometry, Al-Ibrahim Eye Hospital, Karachi, Pakistan*

[2]*Ophthalmologist, ISRA School of Optometry, Al-Ibrahim Eye Hospital, Karachi, Pakistan*

[3]*Professor of Ophthalmology, Al-Tibri Medical College, ISRA Postgraduate Institute of Ophthalmology, Karachi, Pakistan*

[4]*Optometrist, Al-Ibrahim Eye Hospital, ISRA School of Optometry, Karachi, Pakistan*

*Corresponding Author: Shua Azam, Assistant Professor, Al-Ibrahim Eye Hospital, ISRA School of Optometry, Karachi, Pakistan.

Abstract

Objective: To determine stereopsis in accommodative esotropia.

Design: Cross-sectional descriptive study between August 2020 to December 2020.

Place and Duration of Study: Al-Ibrahim Eye Hospital, Karachi.

Methodology: Non-probability, convenient sampling was used. This study included 23 subjects diagnosed with accommodative esotropia under 5 to 15 years of age, either male and female. Stereopsis was assessed by the Frisby test and Lang II test. SPSS version 20.0 was used to analyze the data. Research Ethical Committee (REC) of ISRA Postgraduate Institute of Ophthalmology gave ethical approval.

Results: A total of 340 subjects were registered at the Orthoptic Clinic. 155 subjects were diagnosed with Esotropia. Among the 155 subjects, 23 subjects were diagnosed with Accommodative Esotropia. The age ranged from 5 to 15 years. Among 23 patients, 10 were females and 13 were males. Stereopsis on Frisby test showed that 7 subjects had weak (340) stereopsis but after refractive correction they attained good (85) stereopsis while 3 had mild (170) stereopsis and it becomes good (85) after refractive correction with a p-value of 0.018 which is statistically significant. 10 subjects who failed to perform on Frisby test their stereoacuity was assessed by Lang-II test. Without refractive correction on Lang-II test 4 patients had 200 sec/arc, 2 patients had 400 sec/arc, 1 patient had 600 sec/arc and 3 patients had no stereopsis. With refractive correction on Lang-II test 5 patients had 200 sec/arc, 3 patients had 400 sec/arc and 2 patients had 600 sec/arc.

Conclusion: The study concluded that stereopsis was good after refractive correction in the majority of the subjects.

Keywords: Stereopsis; Accommodative Esotropia; Frisby Test

Introduction

Stereopsis is the process responsible for the construction of the depth dimension in our visual world by combining two different 2-D images of the objects around us [1]. The principle for evaluating the stereoacuity threshold is based on the minimum disparity that one can detect [2]. Stereoacuity testing is carried out by dif-

ferent tests like Lang I and Lang II [3], Frisby stereotest [4,5] TNO test in which Red- and green-colored spectacles are used to create disparity [6] while polarized glasses are used in the Titmus test [7]. Accommodative Esotropia (AE) is a form of strabismus characterized by convergent misalignment of the visual axes that can be associated with hyperopia and abnormal fusional divergence [8]. Stereoacuity maturation normally proceeds rapidly during the first year of life however, accommodative esotropia is associated with profound and permanent disruption of stereopsis [9] and depends on refractive error, angle of deviation and fusional ability [10]. In this cross-sectional study, the aim was to find stereopsis in accommodative esotropia.

Methods

This was a descriptive cross-sectional study including all the patients diagnosed with accommodative esotropia registered at Orthoptic Clinic, Al-Ibrahim eye hospital, Karachi between June and December 2020. This study was approved by the Research Ethics Committee (REC) of ISRA Postgraduate Institute of Ophthalmology.

The protocol for examination for all patients who were evaluated at the Orthoptics included the demographic data, history of onset, type of squint retrieve from the case note. The visual acuity of every patient was checked and recorded separately both for near and distance, with and without glasses and with pin-hole. The orthoptic assessment included Hirschberg and Cover test. Near point of accommodation (NPA) and Near point of convergence (NPC) were checked by RAF rule. Prism cover test at 33 cm for near and 6 meters for distance with spectacles and without spectacles was performed. Stereopsis was assessed by using the Frisby test and Lang II test. All patients were examined after obtaining fully informed consent.

Data analysis was done on statistical package for the social sciences (SPSS) version 20.0. Chi-square test was used to compare stereopsis before and after refractive correction. A p value < 0.05 was considered statistically significant. The entire categorical variables were shown in frequencies and percentages.

Results

A total of 340 subjects were diagnosed at Orthoptic Clinic. 155 subjects were diagnosed with Esotropia. Among the 155 subjects, 23 subjects were diagnosed with Accommodative Esotropia. The age ranged from 5 to 15 years. Among 23 patients, 10 were females and 13 were males. Stereopsis was assessed with the Frisby test

and Lang-II test. Frisby test was performed at a distance of 40 cm on 13 patients, among them 5 were females and 8 were males. Chi-Square test was applied to compare Stereopsis before and after refractive correction. 7 subjects had weak (340 sec/arc) stereopsis but after refractive correction, they attained good (85 sec/arc) stereopsis while 3 had mild (170 sec/arc) stereopsis and it becomes good (85 sec/arc) after refractive correction with a p-value of 0.018 which is statistically significant as shown in table 1.

Without refractive correction Good 85 sec/arc		With correction		Total
		Weak 340 sec/arc		
No stereopsis	Count	0	2	2
	%	0.0%	66.7%	15.4%
Mild 170 sec/arc	Count	3	0	3
	%	30.0%	0.0%	23.1%
Weak 340 sec/arc	Count	7	1	8
	%	70.0%	33.3%	61.5%
Total	Count	10	3	13
	%	100.0%	100.0%	100.0%

Table 1: Comparison of stereopsis with and without refractive correction on Frisby test.
*Pearson Chi-Square = 0.018.

10 subjects who failed to perform on Frisby test their stereoacuity was assessed by Lang-II test. This test was also performed at 40 cm. Among 10 patients, 5 (50%) were females and 5 (50%) were males. Without refractive correction on Lang-II test 4 patients had 200 sec/arc, 2 patients had 400 sec/arc, 1 patient had 600 sec/arc and 3 patients had no stereopsis (Table 2). With refractive correction on Lang-II test 5 patients had 200 sec/arc, 3 patients had 400 sec/arc and 2 patients had 600 sec/arc (Table 3).

Without correction	Frequency	Percent
Good 200 sec/arc	4	40.0
Mild 400sec/arc	2	20.0
Weak 600 sec/arc	1	10.0
No stereopsis	3	30.0
Total	10	100.0

Table 2: Stereopsis on Lang-II test without refractive correction.

With correction	Frequency	Percent
Good 200 sec/arc	5	50.0
Mild 400 sec/arc	3	30.0
Weak 600 sec/arc	2	20.0
Total	10	100.0

Table 3: Stereopsis on Lang-II test after refractive correction.

Discussion and Conclusion

This study included 23 subjects diagnosed with accommodative esotropia. The age ranged from 5 to 15 years. Males were more than females' subjects and the same results were shared by another study from Pakistan where the percentage of males for about 57.1% and females 42.9% [11,12]. In contrast with a study conducted in Lahore showed a higher frequency of females 58.3% and in males 41.7% [13]. Our study age group was 5 - 15 years. While another study from Pakistan took ages from 0 - 6 years [12] and a study conducted in Turkey took ages ranged from 4 to 24 years [14].

In a study from Pakistan, the mean near deviation was 23.33 ± 9.57 prism diopter and they reported that good stereopsis is possible if the hyperopic mean error is less than or equal to 2 diopters while our study results showed a mean near deviation of 27.61 ± 12.23 [11] and stereopsis becomes good stereopsis (85sec/arc) after refractive correction in smaller deviation and same results were shared by another study [10]. While a study from Japan reported that better levels of stereoacuity are possible if the residual esodeviations at near and at distance are kept minimal and the patient is under full refractive correction with glasses [15]. A study from Turkey reported that poor Stereoacuity was significantly related to low Visual Acuity, presence of amblyopia, increased duration of deviation, presence of amblyopia, and irregularity of amblyopia treatment [12]. Another study carried out in Turkey retrospectively reviewed the charts of 147 patients whose esotropia was corrected to within 10 prism diopters of orthotropia at both distance and near with use of full cycloplegic hyperopic correction reported that amblyopia is commonly presented in patients with accommodative esotropia and the majority of the patients attained good fusion but poor stereopsis at the end of treatment [16].

Iqbal M., *et al*. concluded that most children with refractive accommodative esotropia (RAE) had a good outcome in terms of visual acuity, ocular alignment, and binocular single vision with the glasses but their study didn't check stereopsis in those subjects [17].

Burcin C., *et al*. reported that there are certain risk factors for the development of stereopsis such as inferior oblique overaction, (best-corrected visual acuity) BCVA in amblyopic eyes, visual acuity difference (VAD), and alternation of fixation (AOF) in subjects with each refractive accommodative esotropia (RAE) and amblyopia [18] and same results were shown by Mulvihill A., *et al*. [19] however, our study did not focus on risk factors.

One more study evaluated stereoacuity in patients with acquired esotropia and determines the factors associated with favorable outcomes. They took 68 subjects aged 6 years and above. They assessed binocular status examination using the Bagolini-striated glass test, The Netherland Organization (TNO), and Randot stereo test. They divided the subjects were into two groups 1 and 2, based on the amount of deviation. Group 1 had a deviation less than or equal to 8 prism diopters (PD) and the duration of misalignment was 1.49 ± 0.86 years, whereas Group 2 had a deviation more than or equal to 10 PD and duration of misalignment was 4.64 ± 2.99 years (P = 0.000). In group 1, 89.5% of subjects achieved fusion and 52.6% of subjects had stereoacuity on both TNO and Randot, whereas in group 2 40% of subjects achieved fusion and 3.3% of subjects had stereopsis on both TNO and Randot. They concluded that horizontal deviation up to 8 PD was compatible with stereopsis [20]. In our study, we used the Frisby and LANG II tests.

Ethical Approval

This study was approved by the Research Ethical Committee (REC) of ISRA Postgraduate Institute of Ophthalmology, Al-Ibrahim eye hospital, Karachi.

Patients' Consent

Informed consent was obtained from all participants.

Conflict of Interest

The authors declared no conflict of interest.

Authors' Contribution

SA: Conception and design of the work, revising it critically, final approval of the version to be published.

AHT: Drafting the work, final approval of the version to be published.

T: Analysis of data, interpretation of data, data collection

M: Literature review, manuscript preparation, data collection

S: Literature review, data collection, manuscript preparation

SN: Literature review, data collection, interpretation of data,

All authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriate.

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