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Review Article

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Stereopsis in Patients of Refractive Accomodative Esotropia

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Abstract

Purpose: To find out the factors that are associated with stereopsis in patients with refractive accommodative esotropia

Material and Methods: Patients with refractive accommodative esotropia were checked. Age, sex, cycloplegic refractive error, angle of deviation, stereoacuity and fusional ability were evaluated. Patients were divided into good stereopsis (40-100arcsec) and poor stereopsis (>100 arcsec group) as well.

Results: Total 30 patients with accommodative esotropia were included in this study. The mean age at presumed age of onset was 2.95 + 1.51 and mean age of the patient at final visit were 6.12 + 1.57.The frequency of male were 56.7% (n=17) and female were 43.3% (n=13).The initial mean cycloplegic refraction was 3.5 + 1.35 D. The mean initial uncorrected deviation at near fixation was 23.33 + 9.57 and was 20.83 + 8.71 at distant fixation. The mean of angle of deviation after treatment was 2.41+ 2.16 at distant fixation and was 2.14 + 1.22 at near fixation. The mean of fusional ability at final visit was 1.87 + 0.93 at near and 1.90 + 0.96 at distance. The mean stereopsis at final visit was 1.67 + 0.47. The independent-t test shows a significant association of refractive error (P- 0.00) with stereopsis. T-test also shows a signification of angle of deviation after correction for both distant and near (P- value 0.003, 0.006 respectively).The uncorrected angle of deviation for both distant and near had no association (p- value 0.53, 0.083 respectively). Chi-square test shows a highly significant association of fusional ability for both distant and near (p-value 0.001, 0.001 respectively) with final stereopsis.

Conclusion: Error of refraction, deviation angle and fusional ability were associated with stereopsis in patients with refractive accommodativeesotropia. The age and gender had no association with stereopsis. The chi- square test shows a significant association of fusional ability with stereopsis. The independent- t test shows a significant association of angle of deviation and refractive error with stereopsis. Good stereopsis can be achieved with hyperopic mean error of less than or equal to 2D.

Keywords: *Stereopsis; Refractive accommodative esotropi; Deviation*

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Introduction

Accommodativeesotropia is considered as a inward deviation of the eyes that has associations with accommodation reflex activation. It can be ruled out with decrease in inward deviation with use of full spectacle cycloplegic correction and the residual distance and near esodeviation are smaller then 8-10 diopters. Patient with refractive accommodative esotropia usually have good binocular functions only if the eyes are aligned by correcting hyperopia. [1-3]

It is found that anisometropia, longer duration of esodeviation4, and residual esodeviation [5-6] are associated with poor type of stereopsis. But we still do not know clearly about the factors associated with stereopsis in refractive accommodativeesotropia. And the criteria to achieve best and normal binocular sensory functions has yet to establish. This study will investigate the associated factors of stereopsis in refractive accommodative esotropic patients.

Subjects and Methods

The present study included patients of refractive accommodativeesotropia seen at Allied Hospital and Madina Teaching Hospital, Faisalabad.

Before examination, cycloplegic refraction was done with instillation 1drop of cyclopentolate 1% in 3 times in 30 mins. In addition cycloplegic refraction was repeated at the interval of 6months to adjust the spectacle correction when needed.

Refractive accommodativeesotropia is now defined as a residual esotropia<10degree after full hyperopic correction. Patients with a history of previous strabismus surgery, a congenital or acquired ophthalmic condition, systemic diseases, amblyopia, poor cooperation during stereopsis testing or the alternate prism cover testing or spherical equivalent difference of more than 2D between the two eyes were not included.

The simultaneous prism cover test were performed to find out the angle of deviation. And only the angle of tropia were checked and noted. Patients who had no manifest deviation on simultaneous cover test were designated as fully accommodative esotropes. On the other hand, with residual manifest deviation were designated as having residual esotropes.

Measurement of stereopsis was done by using Titmus test. Patient were shown the stereogram at distance of 40cm when he was wearing polarizing glasses.

Fusion is checked using the worth 4-Dot test at distance as well as near fixation. The results divided into further three groups named, fusion. Suppression and diplopia.

All the data was entered and analyzed using Statistical Package for Social Science (SPSS Version 20.0). All the data was presented in forms of bar charts.

Results

A total of 30 patients with accommodative esotropia were included in this study. The mean age at presumed age of onset was 2.95 ± 1.51 and mean age of the patient at final visit were 6.12 ± 1.57.The frequency of male were 56.7% (n=17) and female were 43.3% (n=13).The initial mean cycloplegic refraction was 3.5 ± 1.35 D. The mean initial uncorrected deviation at near fixation was 23.33 ± 9.57 and was 20.83 ± 8.71 at distant fixation. The mean of angle of deviation after treatment was 2.41± 2.16 at distant fixation and was 2.14 ± 1.22 at near fixation. The mean of fusional ability at final visit was 1.87 ± 0.93 at near and 1.90 ± 0.96 at distance. The mean stereopsis at final visit was 1.67 ± 0.47.

Variables	Values Mean	Standard Deviation S.D
Age at presumed onset, years	2.90	1.51
Age at final Visit	6.13	1.57
Gender		
Male	1.43	0.504
Female		
Initial Cycloplegic refractive Error	3.5	1.35
Initial uncorrected deviation		
At distant	20.83	8.71
At near	23.33	9.57
Deviation after treatment		
At Distant	2.41	2.16
At near	2.14	1.22
Fusional ability at final visit		
At distant	1.90	0.96
At near	1.87	0.93
Orthophoria and residual esotropia	1.53	0.507
Stereopsis at final visit	1.67	0.47

Table 1: *Characteristics of the accommodative esotropia with general variables.*

Factors associated with stereopsis

Out of 30 patients 33.3% (n = 10) had good stereopsis and 66.7% (n = 20) patients had poor stereopsis.

Mean Refractive error

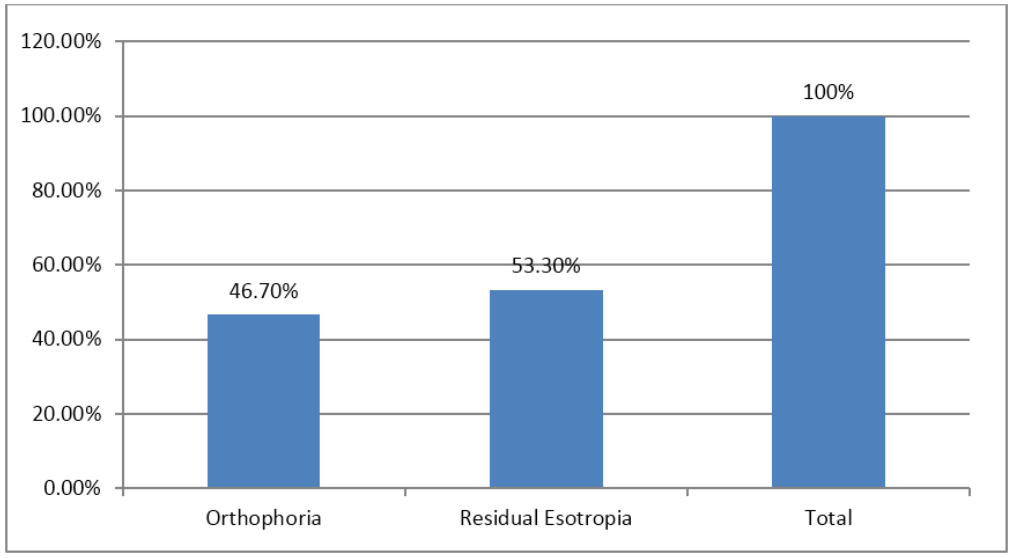
The initial mean cycloplegic refractive error was 2.00 ± 0.577 in good stereopsis group and was 4.27± 0.90 in poor stereopsis group (P- 0.00).

Variables	Stereopsis (Means and S.D)		P-Value
	Good	Poor	
Age at presumed Onset	2.05+1.49	3.4+1.35	0.19
Age at final visit	5.20+1.03	6.60+1.60	0.18
Gender	1.40+0.51	1.45+0.51	0.80
Initial Cycloplegic			
Refractive error	2.0+0.57	4.27+0.90	0.00

Table 2: *Status of stereopsis with General variable and refractive Error.*

Orthophoria and Residual esotropia

Out of 30 refractive accommodative esotropic patients there were 46.7% (n = 14) patients were orthophoric and 53.3% (n = 16) patients were with residual esotropia.



Angle of Deviation

The initial uncorrected deviation at near was 19.1 ± 6.4 in good stereopsis group and was 25.45 ±10.31 in poor stereopsis group (P value 0.08). The initial uncorrected deviation at distant was 19.40 ± 8.42 in good stereopsis group and was 21.55 ±8.98 in poor stereopsis group (P value 0.53). The final angle of deviation after treatment at distant was 0.86 ± 0.76 in good stereopsis group and was2.2± 0.49 in poor stereopsis group (P value 0.03). The mean of final deviation after treatment at near was 1.30 ± 0.43 in good stereopsis group and was 2.56 ± 1.29 in poor stereopsis group (P value 0.006).

variables	Stereopsis (mean + S.D)		P- Value
	Good	Poor	
Age at presumed onset	2.05 +1.49	3.4 + 1.35	0.19
Age at final visit	5.20 +1.03	6.6 +1.60	0.018
Gender	1.40+ 0.51	1.45+0.51	0.803
Initial uncorrected			
deviation at distance	0.86+0.76	3.1+2.22	0.53
Initial uncorrected deviation at near	19.1+6.4	25.45+10.31	0.087
Final deviation after treatment at distant	19.40+8.42	21.55+8.98	0.003
Final deviation aftertreatment at near	1.30+0.34	2.56+1.29	0.006

Table 3: *Status of stereopsis with General Variables and Angle of deviation.*

Fusional Ability

The mean distant fusional ability at final visit was 1.90 + 0.96 and at near was 1.87 + 0.93. There were 50% (n = 15) patient were with distant fusional ability, 10% (n = 3) patients were diplopic and 40% (n = 12) patients were with suppression at final visit. There were 50% (n = 15) patients were with near fusional ability. 13.3% (n = 4) patients with diplopia and 40% (n = 12) patients were with suppression.

The distant fusional ability were present at final visit in 10 patients in good stereopsis group, and 5 patients were with fusion, 3 patients with diplopia and 12 patients were with suppression in poor stereopsis group (p_{chi} value 0.001).The 10 patients with fusion

were present in good stereopsis group at near, 5 patients were with fusion, 4 patients were with diplopia and 11 patients were with suppression in poor stereopsis group at near (P_{chi}– value 0.001).

Variables	Stereopsis		P- value
	Good	Poor	
Age at presumed onset (mean ± S.D)	2.05±1.49	3.40±1.35	0.16
Age at final visit (mean ± S.D)	5.20±1.03	6.60±1.60	0.15
Gender%(n)			
Male	6	11	0.79
Female	4	9	
Near Fusional Ability %(n)			
Fusion	10	5	0.001
Diplopia	0	4	
Suppression	0	11	
Distant fusional ability %(n)			
Fusion	10	5	0.001
Diplopia	0	3	
Suppression	0	12	

Table 4: *Status of stereopsis with General variables and Fusional ability.*

Association with age and gender

The chi- square test show no association (p- value 0.16) of presume onset of age, Age at final visit (P-value 0.15) and gender (p-value o.555) with final stereopsis.

Discussion

In this study, despite using full correction and having well centered eyes, only 33% of total patients had 100arcsec or better stereo-acuity, the mean refractive error and final corrected angle of deviation were smaller in group of good stereopsis. This study also reveals that orthotropic group had better stereopsis then residual group.

Leske and collegues7also showed that maximum angle of horizontal strabismus is related to true stereopsis. They reported that stereopsis may seems to be rare with a horizontal deviation of >4 degree, there was no patient found who had true stereopsis with horizontal deviation of >10 degree of deviation, 12% of their patients had accommodative esotropia.

It is showed by most of the studies that stereopsis has onset at the age of 3-4months and 4-12 months, stereo acuity maturation rate is higher [8-9]. Presentation of accommodativeesotropia is mostly between 2 to 3 years of age. So, if refractive accommodative esotropic patients are orthophoric after full correction, then they have the chances to have good stereo acuity. However, Birch [10] noted the functional organization of the maturing visual system shows to be sensitive to disturbing the abnormal visual experiences during the first month of life, and expectedly continues till 4 years of age. It is also noted that even full orthophoria is achieved, the abnormal ocular experience act as a factor for the unfavorable prognosis of normal development of stereopsis.

In this study, there was no difference in age between the poor and good stereopsis group. Even if parents' recalling of the occurrence of esodeviation is wrong, there are differences in the age of stereopsis and other factors that affect the stereopsis. Moreover, there were previous reports that the binocular sensory outcome may be effected by duration of eye misalignment of both eyes. [1,4]

In our study, even with no drastic difference in duration of esodeviation in two groups as both groups had almost difference of one year in onset of esotropia and start wearing the glasses. So this may affect negatively on recovery of stereopsis. Early detection and treatment are important for maintaining good stereopsis.

Strength and limitations of study

1. The main limitation of the study was small sample size.
2. As titmus fly test is used for stereopsis, so it is prone to the monocular clues.

Competing Interest

The authors declare that they have no competing interests.

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