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Comparative Evaluation of Functional and Anatomical Outcome of Strabismus Surgery Performed Before Completion of Amblyopia Therapy and After Completion of Amblyopia Therapy in Children Under Nine Years of Age

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ABSTRACT

Background: To determine timing of strabismus surgery, is it better to do strabismus surgery before completion of Amblyopia therapy or after completion of amblyopia therapy. **Methods:** 40 children were taken for this study. These children were divided into two groups of 20 each. Amblyopia was fully treated in group A and in group B children underwent surgery before full treatment of amblyopia in the form of occlusion therapy. Motor success (10 PD of orthophoria) was assessed after three months of surgery and at the child's most recent visit. Sensory success was assessed by comparing the frequency of detectable stereoacuity. **Results:** There was no significant difference in motor success (65% vs 80%) and sensory success (65% vs 75%) whether amblyopia was fully treated or partially treated. **Conclusion:** It is not mandatory to treat ambloypia prior to surgery and amblyopia therapy can be continued post operatively.

Keywords: Amblyopia, Strabismus, occlusion therapy

INTRODUCTION

Strabismus is a condition in which the eyes do not properly align with each other when looking at an object.[1] It is believed that the sensitive period for binocularity begins at 10-16 weeks of age and peaks at 1-3 years.[2] Any disruption of ocular fusion and binocularity may lead to ocular misalignment and strabismus. Prevalence of strabismus in population with predominantly white ethnicity was generally higher than those of East Asian descent. Children from Mexico, Iran and African, American and Latino-Hispanic children in USA have strabismus rates ranging from 2-2.5%.[3] Population based studies from India reported that refractive errors were a major cause of visual impairment in 61% of eyes in rural and 81.7% of eyes in urban population. In a review of population based and school-cohort studies, the global estimates of prevalence of amblyopia range from 0.20%-6.2%.[4] Amblyopia or lazy eye is a disorder of sight due to the eye and brain not working together.[5] There is a sensitive/critical period within the first 2 decades of life during which visual development must occur.[6] If treatment of amblyopia is not initiated prior to this time, adult level of vision may never be achieved. Stereopsis is not present at birth but develops with the improvement in visual acuity.

Vision therapy consists of eye exercise that helps patients gain improved control of their eye movements. Vision therapy has been shown to be helpful in treating amblyopia and strabismus. Vision therapy in adults has not been thoroughly studied although two case studies of successful vision therapy treatment of childhood onset intermittent basic exotropia in adults have been documented.[7]

Most surgeons will consider surgery for an esotropia more than 15 PD, exotropia greater than 20 PD. Strabismus surgery can involve resecting or recessing one or more extraocular muscles. Botulinum toxin inj. into extraocular muscle to weaken it is an alternative to traditional surgery.Botulinum toxin is most often used for

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infantile esotropia treatment but it has also been used for acute onset starbismic deviation in adults.[8]

MATERIALS AND METHODS

The present study entitled was conducted in the Department of Ophthalmology, Govt. Medical College, Amritsar (Punjab), performed on 40 children diagnosed with horizontal strabismus after taking informed consent from their parents and approval from institutional ethical committee.

Inclusion Criteria

Children with horizontal squint, age less than or equal to 9 years

Exclusion Criteria

Vertical strabismus, Phorias, Squint due to sensory causes, Age more than 9 years, Babies lost to follow-up, children with incomplete record.

Children were evaluated for age at onset of strabismus, type of strabismus, pre and post-operative visual acuity, deviation at first presentation, deviation at 3 months postoperatively and status of binocularity. Visual acuity was tested in verbal Children by Snellen's Chart or Illiterate E letters. Amblyopia was categorized as Mild, Moderate and severe according to following table.

Degree of Amblyopia	Preverbal	Verbal
None	Alternating fixation equally or holds well (at least 5 to 6 seconds or through blink)	Equal visual acuity (eg.20/20, 20/30 both eyes)
Mild	Maintaining fixation briefly (hold for 1–3 seconds)	One to two lines acuity difference
Moderate	Unmaintained fixation (immediate refixation to preferred eye)	3–5 lines acuity difference
Severe	Unable to fixate	More than five lines acuity differences

Children who came with horizontal strabismus, completing the criterion of study were randomly divided into two groups A and B.

In group A: Occlusion therapy was started after initial evaluation according to their age until the subject improved to alternate fixation or equal visual acuity and they were classified as having no amblyopia for the purpose of study. Occlusion therapy was given for at least 3 weeks and maximum for 3 months in both the groups. The children in Group A who could not improve by this time were excluded from study due to short time of study period. Surgery was then performed and children were followed on day 1, 2 weeks, 1 month and 3 months for BCVA. The angle of deviation present after the surgery was measured at 3 months postoperatively. Subsequently patients were also tested for presence or absence of stereopsis at 3 months.

In group B after initial evaluation, appropriate recommended surgical procedure was performed and occlusion therapy was started at approximately 1week after the surgery. BCVA was recorded at day 1, 2 weeks, 1month and 3 months for BCVA. The angle of deviation present after the surgery was measured along with status of stereopsis at 3 months. All children underwent occlusion therapy. In group B, occlusion was continued again starting at one week postoperatively. The angle of deviation present after the surgery was measured at 3 months postoperatively in both the groups. Subsequently children were also tested for presence or absence of stereopsis at 3months.

RESULTS

Table 1: Distribution of Mean Age at Their First Presentation

Variables	Age (In years)			
Group	N	Mean	Std. Deviation	p-value
A	20	5.35	1.53	0.751
B	20	5.20	1.43	9NS)

Test applied: Student t-test

Mean age for group A is 5.35±1.53 and for group B it is 5.20±1.43.

Table 2: Distribution of Squint Angle

Squint Angle in PD	Group A	Group B
Mean ±SD	47.50±7.86	48.50±6.70
Total	48.0±7.23	

The mean squint angle recorded in the study population was 48.0 PD. In Group A mean squint angle was 47.50 PD and group B 48.50 PD.

Table 3: Motor Improvement In Squint Angle After Surgery

Variables	Post-OP Squint Angle (after 3 months)		p-value
Groups	<10 PD	>10 PD	
A	13	7	
	65%	35%	
B	16	4	0.288
	80%	20%	
Total	29	11	
	72.5%	27.5%	

Test applied: Chi-square test.

Table 4: Sensory Improvement (Stereopsis)

Variables	Stereopsis at 3 months after surgery		p-value
Groups	Absent	Present	
A	7	13	
	35%	65%	
B	5	15	0.490
	25%	75%	
Total	12	28	
	30%	70%	

Test applied: Chi-square test.

[Table 3], depicts the distribution of improvement in squint i.e. squint angle less than 10 PD achieved after surgery among study groups. On analysis using chi-square test; in group A 65% and in group B 80% showed reduction in angle; the level of improvement between the groups were found statistically non-significant ($p \geq 0.05$).

[Table 4], depicts the distribution of stereopsis among study group. On analysis using chi-square test no statistical significant difference between the study groups was observed for the presence of stereopsis (group A 32.5% and group B 37.5%); $p \geq 0.05$

DISCUSSION

Strabismus is the one of the major causes of treatable childhood blindness which when left untreated leads to development of amblyopia. It is also a cause of social stigma which leads to underdevelopment of children. An early and appropriate treatment can prevent both.

Several studies have reported the outcome of treatment of strabismus and amblyopia therapy but there are very few studies which have reported whether amblyopia should be treated before the strabismus surgery or after it.

We have conducted this present prospective clinical study to determine whether or not amblyopia must be fully treated before strabismus surgery or after surgery to yield the best motor and sensory results.

In the present study the distribution of age within the two groups was found approximately similar. The mean age at first presentation in group A was 5.35 years and 5.20 years in group B. Dadeya et al.9 reported mean age of 3.2 years in group A and 3.0 years in group B. Meyer et al.[10] reported that the age of 10.9 months in group A and 11.1 months in group B. Micheal X Repka et al.[11] reported mean age n acquired strabismus patients was 3 years. Birch et al.[12] reported the mean age to be 4.6 months.

In our study the distribution of sex within the two groups is approximately similar. The proportion of male children was 57.5% in group A and 42.5% in group B. Meyer K et al.[10] 1998 conducted a study in which they also found 45% were males and 51% were females. Birch et al.[12] reported 43%females and 57% males.

In the present study the distribution of amblyopia in the two groups is quite similar. Mild amblyopia (group A 30% and group B 27.5%) and Moderate amblyopia (20% in group A and 22.5% in group B) the p value for the difference in distribution between the groups was 0.759.Meyer K et al. (1998)10 found that the distribution of amblyopia in the two groups was similar with a median class of 2 in both groups. The p value for the difference in distribution between the groups was 0.14.

In our study, 20 (50%) presented with squint angle of 40-45 PD followed by 12 (30%) 46-50 PD and 8 (20%) were found with squint angle 56-60 PD. Overall mean angle reported in the present study was 48.0 PD. Kampanartsanyakorn S et al.[13] reported 44.1PD of squint angle. In the present study mean squint angle in group Awas 47.50 PD and ingroup Bwas48.50.Dadeya et al.[9] reportedmean angle of 42PD in group A and 44PD in group B. Meyer K et al.[10] reported mean angle of 19PD in group A and 21.3 PD in group B.

In the present study the distribution of best corrected visual acuity achieved among subjects in both the groups showed improvement in the BCVA but improvement in Group A was better as compared to group B. A study conducted in 1992 reported that after an average treatment period of 4 months 90% of the patients had significant improvement in visual acuity.[14]

In the present study the surgical success rate for patients with moderate amblyopia was poor only among the infantile group (23.8%). The patients with acquired esotropia had 89.3% success rate. The difference in success rate between the infantile and acquired group was statistically significant. Our findings were found in agreement with the results observed by Dadeya S and Kamlesh MS (2001).[9]

Stereopsis is not present at birth but starts to develop within the 3rd and 4th months of life and rapidly develops during the first 6 months of life in humans.[15,16] Prospective studies showed that surgical alignment within the first 24 months of life is associated with better stereopsis, 17 especially within the period of plasticity at 2−4 months of age for the development of stereopsis.18In the present study 65% patients in group A showed motor success vs 80% in group B with a $p > 0.05$.Stereopsis was achieved in65% in group A and in 75% of participants in group B. On analysis no statistical significant difference between the study groups were observed for the presence of stereopsis ($p \geq 0.05$), suggesting that presence of amblyopia doesn't affect success of strabismus surgery. Our findings were in agreement with the findings of other authors Zak et al.[19] 1982 that for esotropia proceeding with surgery is reasonable even if amblyopia persists. In another study conducted by Dadeya S and Kamlesh MS 20019 showed motor success 84%and 75% and sensory success of 55% and 50% in Group A and B respectively which were statistically insignificant. Similar results were observed by Altınsoy HI et al.[20] 2016 who suggested that there was no significantly increase in proportion of children in the early surgery group who developed stereopsis as compared to children in the other group. In final report of the "early vs late infantile strabismus surgery study" (ELISSS), cases with early surgery (between 6−24 months) had better stereopsis in comparisonwith the cases with delayed surgery (between 32−60 months) at a 6-year follow up.[21]

However Helveston EM22 reported that only 4 (25%) cases had stereopsis out of 10 cases of infantile ET who had BMR surgeries within 6 months (83−159 days) of age with a long-term follow up, and they pointed out that the development of stereopsis could be increased with early surgery and stereopsis might be developed by structural factors rather than the timing of the surgery, although duration of misalignment within the critical period has been found to be the most important factor for the development of stereoacuity in some studies. First, large-scale retrospective reviews of clinical data, such as those conducted by Ing23 and by Taylor24 have reported that fusion and stereopsis are more commonly found in children whose eyes were initially aligned by age 24 months than in children whose eyes were initially aligned after 24 months.

Classic teaching recommends treatment of amblyopia prior to surgical intervention. It may require postponing the surgical intervention till completion of amblyopia therapy. In this way surgical intervention may be delayed for months or years in intractable amblyopia, thus denying the benefits of early surgery to these patients. Hence the question arises, why wait till completion of amblyopia therapy and deny the benefits of early surgery to these patients. Moreover early alignment is important for the improvement of appearance both psychologically and socially in infantile esotropia. It is suggested that early alignment may aid in the development of fine motor skills and visually directed skills. However, it must be emphasized to the parents that amblyopia therapy must be continued post-operatively, because after surgical alignment patients may gain a false sense of security that there is no need for amblyopia therapy. Moreover, it might be difficult to interpret fixation preference in post-operatively straight eyes with small deviations. Moreover, Lam et al. (1993),[25] and Weakely DR (1997),[26] have suggested that performing surgery before the completion of amblyopia therapy does not affect the motor or sensory outcome adversely, provided amblyopia therapy is continued post operatively.

Limitation of our study was shorter time span of study and less number of patients.

CONCLUSION

So it is concluded from above study that it is not mandatory to treat amblyopia prior to surgery in horizontal strabismus. However, amblyopia therapy must be continued post-operatively. More studies involving longer follow-ups and large sample size are required to be done to increase the validity of results.

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