

# ASTIGMATISM AND EARLY ACADEMIC READINESS IN SCHOOL CHILDREN

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## ABSTRACT

**Background:** Astigmatism may effect schooling among children. **Objective:** To determine the effect of uncorrected astigmatism on the readiness of child to go to school. **Methodology:** This cross-sectional study was conducted on 61 children and vision screening was performed on these children admitted in nursery and prep class of Government Paisa & Akhbar School Lahore from 1<sup>st</sup> October to 30<sup>th</sup> November 2015. A questionnaire was asked from the in-charge of each class. The questions represented the different scales of academic readiness. These questions included physical health, personal and social development, academic performance, reluctance while coming to school, attention, language and literacy. The children with astigmatism (defined as  $>0.5$  or equal to  $0.5$  in either eye) were compared with children who had no astigmatism. Association between the astigmatism and each scale of academic readiness was measured by applying qualitative chi square test. The effect of age and spherical refractive error was ignored. The data was entered and analyzed by using SPSS version 13. **Results:** A total of 61 students participated in this study. 21 students were of age 4 years and 40 children were of age 5 years. 35 children were non-astigmatic and 25 children were astigmatic. There was no significant effect of uncorrected astigmatism on health and development ( $P=0.2$ ), reluctance to go to school ( $p=0.08$ ) and school attendance ( $p=0.3$ ). This may be due to the fact that our schools are not that efficient to record the academic performance across the developing years. There was a significant effect of astigmatism on academic readiness ( $p=0.02$ ), language and literacy ( $0.05$ ). **Conclusion:** The study showed that there was significant effect of astigmatism on academic readiness, language and literacy whereas there was no significant effect on health & development, reluctance to go to school and school attendance. This study emphasized on the importance of early vision screening in preschoolers so that children can see clearly in early years of their visual development and academic learning.

**Key Words:** Astigmatism, Preschoolers, Academic Readiness.

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## INTRODUCTION

Astigmatism is a refractive error in which parallel rays of light when enter in non-accommodating eye are not focused on retina and the resulting image of both near and distance object is either elongated or broadened.<sup>1</sup> Adults have varying ability to tolerate distortions while younger children adapt to their full astigmatic correction.<sup>2</sup> Like myopia and hyperopia, uncorrected astigmatism cannot bring visual stimuli in to focus by adjusting accommodation or by changing the distance. In the absence of significant myopia, young uncorrected astigmatism can have clear visual input for all direction by bringing portion of the image in to focus, but they are unable to bring all stimulus components simultaneously in focus.<sup>3</sup> The prevalence of astigmatism in children of different countries was reported as; 17.2% in Chinese, 8.22% in Indians, 3.32% in Nepal and 8.81% in African children. Female gender, young children and pure spherical equivalent show association with high astigmatism.<sup>4,5,6</sup> Effect of refractive error on academic

performance is a complex phenomenon.<sup>6</sup> Myopic children do not have reading problem except for the high myopia. However the distance target for myopia is blurred. Hyperopic children can see clearly both at distance and near depending on the age and magnitude of hyperopia.<sup>7</sup> Children with astigmatism are unable to focus all the orientations on each distance. The provision of free eyeglasses to Chinese school children for the correction of myopia has exponentially increased their academic performance.<sup>7,8</sup>

A previous study showed that astigmatism has significant effect on learning and literacy.<sup>9</sup> This study was conducted to determine the effect of uncorrected astigmatism on the academic readiness of child to go to school.

## METHODOLOGY

This cross sectional study was conducted at College of Ophthalmology and Allied Vision Sciences (COAVS) Lahore from 1<sup>st</sup> October to 30<sup>th</sup> November 2015. Astigmatism was defined as  $\pm 0.50$  D or  $>0.50$ D in either or both eyes. This study was

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conducted in the Government. Paisa & Akhbar School, Lahore. Children admitted in the prep and nursery class (4-5years of age) were included in this study. LOG MAR chart was used to screen the patients for any uncorrected refractive error. Cover and uncover test was used to detect children having tropia and phoria. Torch light was used to check any apparent ocular infection and abnormality.

Optic disc and macula was checked with direct ophthalmoscope. Children having any apparent ocular abnormality were excluded. Academic readiness was checked by filling the self-designed questionnaire by the in-charge of each class. The data was recorded on the proforma entered and analyzed by using SPSS version 13.0. The astigmatic children were compared with their non-astigmatic students on the different scales of academic readiness, physical health & development, reluctance to come to school, attendance, academic performance and language and literacy.

Early academic readiness was recorded by response of the class teacher, on each of the following subject of questionnaire regarding current study, health and development (categorized as good, average and poor health), reluctance to come to school (high, average and no reluctance), school attendance (good, average and poor), academic performance (good, average and poor) and language and literacy skill (good, average and poor).

## RESULTS

35 children were non-astigmatic and 25 children were astigmatic. The range of astigmatism (absolute amount) was 0.5 to 2.75D (2 participants). With the rule astigmatism was found in 3 participants. 16 participants showed against the rule astigmatism. Only 2 participants has oblique astigmatism. Out of 61 students appeared in the study 21(34.4%) children were of age 4 year and 40 (65.5%) children were of age 5 years. Right eye visual acuity of 32 (52.5%) children fall in the range of 0.0-0.1 Log MAR, 14(23%) children had 0.2 Log MAR. 14(23%) children had 0.3 Log MAR and only one student showed in the range of 0.4 Log MAR. Left eye visual acuity of 32 students fall in the range of 0.0-0.1 Log MAR, 12 students had 0.2 Log MAR, 14 (23%) students had

0.3 Log MAR and 3 (4.9%) students showed in the range of 0.4 Log MAR.

**Table I: Association of health & development in astigmatic and non-astigmatic children**

Health	Non-astigmatic	Astigmatic
Good Health	30 (85%)	18 (72%)
Average Health	5 (15%)	7 (28%)
Total	35 (100%)	25 (100%)

Table I shows that out of 35 non-astigmatic children, 30(85%) showed good health and 5(15%) showed average health and out of 25 astigmatic children 18(72%) showed good health and 7(28%) showed average health. ( $p=0.2$ )

**Table II: Association of reluctance to come to school and astigmatism**

Reluctance	Non-astigmatic	Astigmatic
High	4 (11%)	4 (16%)
Average	2 (6%)	6 (24%)
No Reluctance	29 (83%)	15 (60%)
Total	35 (100%)	25 (100%)

Table II shows that out of 35 non-astigmatic children, 4(11%) showed high reluctance, 2(6%) showed average reluctance and 29(83%) showed no reluctance and out of 25 astigmatic children 4(16%) showed high reluctance, 6(24%) showed average reluctance and 15(60%) showed no reluctance. ( $p=0.08$ )

**Table III: Association of school attendance and astigmatism**

Attendance	Non-astigmatic	Astigmatic
Good	25 (71%)	14 (56%)
Average	8 (23%)	10 (40%)
Poor	2 (6%)	1 (4%)
Total	35 (100%)	25 (100%)

Table III shows that out of 35 non-astigmatic children, 25(71%) showed good attendance, 8(23%) showed average attendance and 2(6%) showed poor attendance and out of 25 astigmatic children, 14(56%) showed good attendance, 10(40%) average attendance and 1(4%) showed poor attendance. ( $p=0.3$ )

**Table IV: Association of academic performance and astigmatism**

Academic Performance	Non-astigmatic	Astigmatic
Good	12 (34%)	2 (8%)
Average	13 (37%)	17 (34%)
Poor	10 (29%)	6 (24%)
Total	35 (100%)	25 (100%)

Table IV shows that out of 35 non-astigmatic children, 12(34%) showed good academic performance, 13(37%) showed average & 10(29%) showed poor academic performance and out of 25 astigmatic children 2(8%) showed good academic performance, 17(68%) showed average & 6(24%) showed poor performance. ( $p=0.02$ )

**Table V: Association of language and literacy with astigmatism**

Language	Non-astigmatic	Astigmatic
Good	23 (66%)	19 (76%)
Average	6 (17%)	4 (16%)
Poor	6 (17%)	2 (8%)
Total	35 (100%)	25 (100%)

Table V shows that out of 35 non-astigmatic children, 23(66%) showed good, 6(17%) average & 6(17%) showed poor literacy level and out of 25 astigmatic children, 19(76%) showed good, 4(16%) showed average & 2(8%) showed poor literacy level. ( $p=0.05$ )

## DISCUSSION

This study was an effort to assess the association of astigmatism with academic readiness. It was reported in a study that presence of uncorrected astigmatism has negative effect on the academic performance.<sup>9</sup> The effect of high hyperopia and astigmatism on the learning potential was checked in a pilot study.<sup>10</sup> It was suggested that these children will score lower on the normative tests than their emmetropic peers. Notable difference was found between the two groups. Uncorrected refractive error lower the potential for child's learning abilities.<sup>10</sup>

This study was conducted in the Government Paisa & Akhbar School Lahore. Astigmatism was defined as  $\geq 0.50$  D or  $>0.50$ D in either or both eyes. Children admitted in the prep and nursery class (4-5) were included in this study. Out of 61 students appeared in the study 21(34.4%) children were of age 4 year and 40 (65.6%) children were of age 5 years.

In this study, 35 children were non astigmatic and 25 children were astigmatic. Astigmatic and non-astigmatic were compared on the different scales of academic readiness (health, fine motor, gross motor, academic performance, memory, visual attention, visual recognition).The p value was  $<0.05$  for the scale of academic performance.

It showed that there was significant difference between astigmatic and non-astigmatic on the scale of academic performance. This study resembles with the study of Orlansky G, Wilmer J et al.<sup>9</sup> The comparison of astigmatic and non-astigmatic on the other scales of academic readiness showed no significant difference as the p value was  $>0.05$ . Another study in Chinese school children showed similar results, increase in academic performance with myopic correction.<sup>7</sup>

A similar study was conducted in Singapore to check the cause of poor visual acuity in preschoolers. It was reported that refractive error was the main cause of poor visual acuity with astigmatism 57.7%, myopia 30.8 %. There was a low prevalence (7.7%) of hyperopia causing poor visual acuity. Other factor was amblyopia.<sup>11</sup>

Latorre conducted a study in which he found that there is increased association between low educational level and uncorrected refractive error in pediatric population leading to high morbidity in later life. Prevalence of visual impairment due to uncorrected refractive error is 12 million. However early intervention of refractive errors can improve acuity and quality of life. Early vision screening and timely intervention is important to detect refractive error in early age. However further research is required in this area.<sup>12</sup>

This study emphasized on the importance of early vision screening in preschoolers so that children can see clearly in early years of their visual development and academic learning. However, this study didn't prove significant effect of uncorrected astigmatism on difference scales of academic readiness. This could be due to the small sample size. The lenient behavior of school in-charge could also be the factor of providing unauthentic information. There is a need to conduct early years of their visual development and academic learning.

## CONCLUSION

The study showed that there was significant effect of astigmatism on academic readiness, language and literacy whereas there was no significant effect on health & development, reluctance to go to school and school attendance. This study emphasized on the importance of early vision screening in preschoolers so that children can see clearly in early years of their visual development and academic learning.



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