

## Are Children with Myopia More Intelligent? A Hospital Based Cross-Sectional Study

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### Abstract:

**Introduction:** The association between myopia and higher intelligence is much debated topic. There is no clear consensus on the fact that myopic individuals have more than average intelligence. There is paucity of studies on this important topic from India, country which have large no of myopic children.

**Material and Methods:** Children of adolescent age group from 12 to 18 coming to ophthalmology OPD had been given option to join the study, after complete ophthalmic examination participants were divided into myopic group and non-myopic group. A total number of 200 participant were taken, 100 each in myopic and non-myopic group. Each participant had undergone intelligence assessment using Raven's standard progressive matrices test. Scores were given to each participant.

**Results:** Mean raven's score was more in myopic group than non-myopic group. But on statistical analysis, the p value was >0.05. Myopic group was further divided into two groups. Group-1 was myopia from -0.25D to -2D and Group-2 was myopia from -2.25 D and above. The mean raven's score was more in group-2. But on statistical analysis the data was statistically non-significant.

**Discussion:** Few previous studies found a positive correlation between myopia and intelligence in children. Age group and intelligence test differed in between these studies. While there are other studies too which did not find any difference in intelligence between myopic and non-myopic children. Result of our study match more closely with the second group.

**Conclusion:** We did not find any concluding evidence on hypotheses "myopic children have more intelligence than non-myopic children". But as the mean raven's score was more in myopic group, we advise further studies with higher number of participants on this topic.

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### Introduction

The association between myopia and higher intelligence is much debated topic. Debate risen from the observation in last century that increase in proportion of myopic individuals in particular population was associated with increase in average level of intelligence in that population. Only few studies have been conducted on this topic to verify this fact, showing variable results. So, there is no clear consensus on the fact that myopic individuals have more than average intelligence. There is paucity of studies on this important topic from India, country which have large no of myopic children. On thorough search of literature, we did not find any Indian study carried on this topic. This study aims at addressing this paucity of literature by examining the evidence for this hypothesis.

### Review of literature

There is high prevalence of myopia among Indian children. Nim study (The North India Myopia Study) found 13.1% prevalence of myopia among urban school children in Delhi. [1] Murthy GV et al. reported 7.45% prevalence of myopia in urban population. [2] Dandona R. et al. found 4.1% prevalence of myopia in rural population in India. [3] Myopia also known as "short sightedness" is that dioptric condition of the eye in which, with accommodation at rest incident parallel rays come to focus in front of the light sensitive layer of the retina. [4] Main reason behind this are either increase in axial length of eye or increase in curvature of cornea or lens. [4] Genetic, educational level, ethnicity and environmental factors which play important role in development

of myopia are also related to the level of intelligence achieved. Hirsch propounded many hypotheses regarding link between myopia and higher intelligence. [5] One of his hypotheses was myopia represent overdevelopment of the eye, with ocular and cerebral development being related. Mak W et al. postulated that intelligence and myopia might be related by single pleiotropic genotype. (nominally called EBG: the “eye-brain gene”) [6]

On review of past studies which were carried out to test association between myopia and higher intelligence, it was found that while many studies have supported this association but there are few studies which have rejected it too. [7]

### Aims and Objective

1) To find out association between myopia and higher intelligence in children of adolescent age group between 12 to 18 years.

2) To find out whether level of intelligence varies with degree of myopia.

### Material and Methods

Institutional ethics committee clearance was taken. Study was carried out in accordance with the world medical association – declaration of Helsinki. Children of adolescent age group from 12 to 18 coming to ophthalmology OPD had been given option to join study after explaining them complete study procedure in detail. Children coming to the particular study hospital, generally had similar socioeconomic background and educational opportunities. If willing to join study, informed written assent was taken from the child and informed written consent was taken from parents.

### Inclusion Criteria

- Children from 12 to 18 age group presenting to eye OPD and giving their informed written assent and informed written consent from their parents for the study.

### Exclusion Criteria

- One eyed.
- Distant vision less than 6/9 on near vision less than N6 in any eye after refractive correction.
- Children with any serious co-morbidities.
- Mentally retarded children.
- Children or their parents not giving assent and consent respectively for participation in the study.

After enrolment for the study; vision assessment, complete ophthalmological examination and dilated retinoscopy was done for all the participant. Distant vision was tested using Snellen distant vision chart from 6 metre distance. Near vision was tested using roman near test chart from 14 inches distance. Colour vision assessment was performed using Ishihara chart. Slit lamp examination was done for all the participants. Pupils of both the eyes were dilated using 2% homatropine eye drop, one drop was put in each eye after every 10 minutes for three times. After complete pupillary dilatation retinoscopy was performed using Heine’s streak retinoscopy from 1 metre in dark room. Fundus examination was performed using direct and binocular indirect ophthalmoscopes. All the examination was performed by same examiner under constant environmental conditions and on same machine to avoid any error in the data collection. Any pathology if spotted, it was noted. Participants were called for PMT (post mydriatic test) after 3 days. At follow up after 3 days PMT was performed by same examiner. Participants whose distant vision was less than 6/9 or near vision less than N/6 in any eye after PMT were excluded from study after proper counselling. Remaining participants were divided into two groups. Myopic group and non-myopic group. Non- myopic group was further subdivided into hypermetropic and emmetropic group. A total number of 200 participant were taken 100 each in myopic and non-myopic group. Each participant had undergone intelligence assessment using Raven’s standard progressive matrices test. Raven’s standard progressive matrices test is widely used in the world for assessment of non-verbal ability. It tests observation and clear-thinking ability. It gives estimate about person’s capacity to observe, solve problem and learn. It is made of 60 multiple choice questions, listed in order of difficulty. Scores were given to each participant.

### Results

Raven’s standard progressive matrices test scores for all the participants were compiled. Mean for each group was calculated. Groups were compared to each other using T-test to see if difference between mean of two groups was clinically significant.

Table 1 shows comparison between myopic and non- myopic group. Although the mean raven’s score was more in myopic group than non-myopic group. But on applying T-test, the p value was >0.05. So, the difference was not statistically significant.

**Table 1: Comparison between myopic and non-myopic group**

Myopic group (Participants)	Mean Raven's standard progressive matrices test score	Non-myopic group (Participants)	Mean raven's standard progressive matrices test score
100	36.163	100	33.86

Further comparison was done between myopic, hypermetropic and emmetropic groups. Table 2 shows the findings. To our surprise, we found highest mean raven's score in hypermetropic group followed by myopic group and lowest score in emmetropic group. But on applying ANOVA test the p value was >0.05. So, the data was statistically non-significant.

**Table 2: Comparison between myopic, hypermetropic and emmetropic Groups**

Myopic group (Participants)	Mean raven's standard progressive matrices test score	Hypermetropic group (Participants)	Mean raven's standard progressive matrices test score	Emmetropic group (Participants)	Mean raven's standard progressive matrices test score
100	36.163	15	41.133	85	32.57

Myopic group was further divided into two groups. Depending on the degree of myopia. Group-1 was myopia from -0.25D to -2D and Group-2 was myopia from -2.25 d and above. These two subgroups were compared again using T-test to see

whether level of intelligence varies with the degree of myopia. (Table- 3) Again, the mean raven's score was more in group with myopia -2.25 d and above. But on applying T-test P value was >0.05. So, the data was statistically non-significant.

**Table 3: Comparison between myopic subgroups. Group 1 myopia (-0.25D to -2.00D and Group 2 myopia (-2.25 and above)**

Myopia (-0.25 to -2.00) (Participants)	Mean raven's standard progressive matrices test score	Myopia -2.25 and above (Participants)	Mean raven standard progressive matrices test score
63	34.778	37	35.43

## Discussion

Difference between mean Raven's standard progressive matrices test score of myopic group and non-myopic group was not statistically significant though myopic group shown higher mean raven's score. To our surprise we got higher score in hypermetropic group but this can be due to low no of participants in this group and other confounding factors. Mean raven's score was more in group with myopia of more than >-2.25 D when compared to group of myopia of -0.25 D to -2 D but again this difference was not statistically significant.

Previous studies from Young FA et al., [8] Saw SM et al., [9] Benbow CP et al., [10] and Lubinski D et al. [11] found a positive correlation between myopia and intelligence in children. Age group and intelligence test differed in between these studies. Saw SM et al. [9] assessed Chinese school children using same nonverbal Raven's standard progressive matrix test as we used in our study.

While there are other studies too which did not find any difference in intelligence between myopic and non-myopic children. Akrami A et al., [12] Dirani M et al. [13] concluded in their studies that there was no difference between IQ of myopic and non-myopic children.

Result of our study match more closely with the second group showing no statistically significant difference in intelligence between myopic and non-myopic children. Limitation of our study was smaller sample size and large range of age group. Strength of our study lies with the fact that standard intelligence test was used for testing intelligence during this study, intelligence tested objectively, clear documentation was made available for the assessment and standardized approach used throughout the study. Also, to best of our knowledge this is the first study carried out on this particular topic in India.

## Conclusion

We did not find any concluding evidence on hypotheses "myopic children have more intelligence than non-myopic children". But as the mean raven's score was more in myopic group and also there is a paucity of studies on this topic especially from India, we advise further studies with higher number of participants on this topic.

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