

## Research Article

# A study on association between intraocular pressure and myopia

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### ABSTRACT

**Background:** Myopia is one of the commonest ocular disorders and has been recognized as a risk factor for glaucoma. Aim of this study is to find the association between intraocular pressure (IOP) and different grades of myopia from low to high and compare it with emmetropia.

**Methods:** Observational study done from January to May 2014. 178 eyes of 100 patients were divided into four groups according to their refractive status. Group 0 – Emmetropia (+0.5 to -0.5D), Group 1- low myopia (-0.75 to -3.00D), Group 2 -moderate myopia (-3.00 to -5.00D) and Group 3 - high Myopia (>-5.00D).A complete ocular examination was done. Intraocular pressure was measured by standard Goldmann applanation tonometer.

**Results:** Mean age of patients was 30.09 (range 11-47 years). The refraction ranged from +0.50D to -9.00D. Group 0 (emmetropia) included 84 eyes and mean IOP was 12.75 (SD: 2.18).Group 1 included 74 eyes with a mean IOP of 12.32 (SD: 2.44),Group 2 had 14 eyes with a mean IOP of 15.00 (SD:2.25)and Group 3 had 6 eyes with a mean IOP 18.5 (SD:0.7).There was no statistically significant difference in IOP between low myopic and emmetropic patients but the IOP in moderate and severe myopia was higher compared to emmetropic patients.

**Conclusions:** There is statistically significant correlation ( $p < 0.05$ ) between IOP and myopia, in moderate and high myopia groups. The IOP was higher in those groups than in emmetropia and low myopia thereby increasing the risk of glaucoma in these patients.

**Key words:** Intraocular pressure, Myopia, Glaucoma

## INTRODUCTION

Myopia is one of the commonest ocular disorders. Its worldwide prevalence is about 30% and up to 80% in certain Asian population. High grade myopia can increase the risk for glaucoma, retinal detachment, and chorioretinal degeneration.<sup>1</sup> An association between intraocular pressure (IOP) and refractive error has been reported in children, young adults and presbyopic adults.<sup>2-4</sup> Most population based studies in adults have found significant relation between intraocular pressure and myopia, although disputed by a few clinical based studies.<sup>4-6</sup> This study aims to find out the association between intraocular pressure and myopia in an adult healthy population containing emmetropes, low myopes, moderate myopes and high myopic individuals.

## METHODS

This is an observational study done in the department of Ophthalmology over a period of 6 months. 178 eyes of 100 patients were included for the study after obtaining clearance of the institutional ethical committee. Informed consent was taken from all the patients.

All of them underwent a complete ocular examination including slit lamp examination, dilated fundus examination, retinoscopy and refraction. BCVA (Best corrected visual acuity) was assessed using Snellen's visual acuity chart. Intraocular pressure was measured by Goldmann applanation tonometer by the same investigator in all cases. Patients with astigmatism >1 Dioptre (D) and hyperopia >+0.50 DS (Dioptre

Sphere), Patients with family history of Glaucoma, history of trauma or surgery in the eye, patients on any topical medications and those with corneal dystrophy and myopic macular degeneration were excluded from the study.

178 eyes of 100 patients were divided into four groups.

Group-0 included Emmetropic patients with refraction ranging from +0.50 to -0.50 DS.

Group-1 included low myopia ranging from -0.75 DS to -3.00 DS.

Group-2 included moderate myopia from -3.00 DS to -5.00 DS.

Group-3 included high myopia >-5.00 DS.

### Data analysis

Values were presented as mean in standard deviation. Statistical Analysis were conducted using a commercial software (SPSS ,Software Version 13.0, SPSS Inc Chicago).One way of analysis of variables (ANOVA) was used for determining whether the values of a particular variable differed between the 3 diagnostic groups. The level of statistical significance was set to  $P < 0.05$ .

## RESULTS

A total of 100 patients (178 eyes) were included in the study. Mean age of the patients was 30.9 years (ranging from 11 years to 47 years). The study included 44

females and 56 males. There was no significant difference in gender distribution among the four diagnostic groups. The refractive error among the included eyes ranged from +0.50 DS to -9.00 DS.

**Table 1: Distribution of refractive error among the different study groups.**

Study population	Distribution	Percentage (%)
Group - 0	84	47
Group - 1	74	42
Group - 2	14	8
Group - 3	6	3

Group-0 – Emmetropia included 84 eyes, Group-1 low myopia included 74 eyes, Group-2 -moderate myopia included 14 eyes and Group-3 – high myopia included 6 eyes (Table 1). The mean Intraocular pressure recorded in group- 0 was 12.75 mm Hg (SD:2.18), Group-1 was 12.32 mm Hg (SD:2.44), Group-2 was 15.00 mm Hg (SD:2.25) and Group-3 18.5 mm Hg (SD:0.7) (Table 2).

**Table 2: Mean intraocular pressure among the four groups.**

Study Groups	Frequency	Mean IOP	SD
0	84	12.7583	2.18765
1	74	12.3284	2.44756
2	14	15.0071	2.24926
3	6	18.5167	.69402
Total	178	12.9506	2.58151

**Table 3: Multiple comparisons of intraocular pressure of emmetropic patients with low myopic, moderate myopic and high myopic patients.**

(I) Emmetropia	(J) Myopia	Mean Difference (I-J) in IOP	SD Error	Significance
0	1	.4299550	.3631391	1.000
	2	-2.2488095*	.6575207	.005
	3	-5.7583333*	.9625117	.000

There was no statistically significant difference in Intraocular pressure between low myopia and emmetropia patients but the IOP in moderate (Group-2) and severe myopia(Group-3) was found to be higher compared to emmetropic patients .The results was statistically significant with a 'P 'value < 0.05 (Table 3).

## DISCUSSION

In this study, we found a positive correlation between intraocular pressure and increasing degree of myopia. The findings were consistent with several previous reports.<sup>7,8</sup> Several studies have reported that the myopic patients especially in the high myopic group showed higher Intraocular pressure than controls.<sup>7,9-11</sup> Myopia is

associated with open angle glaucoma in white adults, with approximately threefold significantly increased odds in moderate to high myopes.<sup>7</sup> In present study we observed that the intraocular pressure was significantly higher not only in the high myopic group but also in the moderately myopic groups compared to emmetropia and low myopic groups.

However no correlation was noted between intraocular pressure and refraction in some studies.<sup>12</sup> Different methods and samples may be the reason for the inconsistent result with different studies. There is an increased prevalence of glaucoma among myopic eyes compared with non-myopic eyes.<sup>7,8</sup> However it is not very clear why myopia causes an increased Intraocular

pressure. There are several hypotheses. One hypothesis is that the increased intraocular pressure is related to an increased stress of the globe wall and decreased ocular rigidity in the myopic eyes.<sup>13</sup>

According to Schmid JL et al In myopic eyes the inner radius of the globe is longer and the globe wall is thinner compared to non-myopic eyes.<sup>13</sup> Myopia has been identified as a risk factor for open angle glaucoma. Increased chance of open angle glaucoma in myopia may be due to stretching and tractional vectors not evenly distributed across the myopic disc, or due to the reduced RNFL (Retinal Nerve Fiber Layer) thickness in myopia.

Pojda SM et al reported that high myopia is more likely to be steroid responders than those in general community, the gene coding for trabecular meshwork induced glucocorticoids response protein in the GLCIA locus on chromosome 1q21-q31 was identified and found in 3.9% of a glaucoma population compared to 0.3% of general population.

It is possible that this and other glaucoma genes may be represented more frequently in persons with myopia. The other possible causes for the association of myopia and ocular hypertension were explained by various studies. Nesterov A et al postulated that, in myopic eyes the ciliary body is in relatively posterior position in relation to canal of Schlemm so that it has less mechanical advantage in widening the spaces in the trabecular meshwork during accommodation.<sup>14</sup>

Fluorescein angiographic studies have suggested a reduced choroidal blood flow in myopes, and the amplitude of the ocular pulse is lower in myopes than in emmetropes or hypermetropes. The circulation to optic disc in myopic eye is also reduced and therefore myopics are more susceptible to raised IOP as suggested by Edward S Perkins and Charles Phelps.<sup>15</sup> Morphologic optic nerve head changes often associated with myopia can mimic or mask glaucomatous changes complicating diagnosis and monitoring.

The main limitation of this study would be that the axial length, corneal curvature and central corneal thickness were not measured. Therefore the role of these factors in the refraction related mechanical changes of the cornea is not known. These factors may influence the correlation between myopia, IOP and biomechanical properties of cornea.<sup>16,17</sup>

The other limitation is that the investigative groups are not age or gender matched which may influence the results. However, no significant differences were found between the females and males in each group. No significant correlation was found in the measured parameters with age. A large sample size with age and gender match and measurement of corneal biomechanical parameters need to be considered in the study design in the future.

## CONCLUSION

There is statistically significant correlation between intraocular pressure and myopia with intraocular pressure being higher in moderate and high myopic groups than in emmetropia or in low myopia, thereby increasing the risk of glaucoma in these patients.

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