Original Article

Role of Full Correction of Myopia in Regulation of Intra Ocular Pressure in Young Persons

Munawar Ahmed, Murtaza Sameen, Mahtab Alam Khanzada, Arshad Ali Lodhi, Azfar Ahmed Mirza

Pak J Ophthalmol 2017, Vol. 33 No. 1

See end of article for authors affiliations

Correspondence to:
Munawar Ahmed
Assistant professor, Department of Ophthalmology,
Liaquat University of Medical & Health Sciences Jamshoro
Email:
munawar_404@yahoo.com

Purpose: To evaluate effects of full myopic correction on intra ocular pressure (IOP) in young persons.

Study Design: Prospective observational clinical study.

Place and duration of study: Department of Ophthalmology (LUMHS) from May 2014 to May 2016

Material and Methods: Using independent simple random sample selection technique 65 patients (15 - 35 years) of either sex having simple spherical myopia -1.0 to -4.0 D, and IOP 14 to 20 mm Hg, wearing glasses for the first time were enrolled for the study. After verbal / written consent initial refraction was done with auto-refractometer followed by subjective correction. IOP was measured with applanation tonometer. Best corrected visual acuity and back vertex distance was noted. Fully corrected prescription using duochrome test was given for full time wear. After one week, the refraction was reconfirmed with glasses, and IOP was measured immediately after removing the glasses. Follow up was done after one month and three months. Each time IOP was measured immediately after removing the glasses.

Results: Out of 65 registered patients 52 completed three months follow up criteria of this study. Among these 52 patients reduction of IOP was observed in 45 (86.54%), and mean reduction of IOP was 2.8790 mm Hg (16.7062%). In remaining 7 (13.46%) patients there was no or little response. Only 10 (19.23%) patients complained of eye strain, which was relieved after few days. After three months follow up data was processed on SPSS version 14.0 and p-value was 0.003 (< 0.05), which is quite significant.

Conclusion: Myopia should not be under corrected in young persons, as full correction is more effective in restoring accommodation and reducing IOP than under correction.

Key words: Myopia, refraction, IOP, full correction, Young patients.

Normal circulation of aqueous humor plays important role in regulation of intra ocular pressure[1]. Intra ocular pressure is increased when accommodation is abolished either by cycloplegics, or by myopia, even when the anterior chamber angle is fully open. The longitudinal fibers of cilliary muscle, which are attached to scleral spur are also relaxed and no longer produce any affect on trabecular meshwork and result in increase in intra ocular pressure. IOP is decreased when pilocarpine is used in open angle glaucoma by inducing accommodation. When normal accommodation is reduced or totally lost in myopia and restored by full refractive correction, it results in reduction of intra ocular pressure especially in young persons[2]. During normal accommodation the resistance to aqueous out

flow is reduced, anterior chamber becomes shallow and pushes the aqueous through the trabecular meshwork and reverse happens in dis-accommodation; resistance to outflow is increased, anterior chamber deepens and aqueous from posterior chamber is sucked into anterior chamber[3]. Therefore repeated accommodation plays important role in regulation of IOP. If myopic persons are left uncorrected for longer time, it can result in cilliary muscle atrophy, exo-deviation, headache and giddiness along with increased intra ocular pressure. Under correction of myopia also produces greater degree of progression of myopia[4], actually under correction of myopia is myopigenic[5]. Similar mechanism operate in primary open angle glaucoma which usually occurs after the age of forty years when presbyopia starts due to decreased cilliary body function, an aging process which cannot be reversed.

In emmetropic persons, Yellow green light is focused on the retina, which is natural phenomenon of colour preference for focusing the images on the retina, but myopics are under corrected (reading better in red on duochrome test) which can lead to so many problems. Several clinical studies have also established relation between intra ocular pressure and myopia[6]. Long standing uncorrected or under-corrected myopia will not tolerate full correction immediately after wearing spectacles due to disuse weakness of cilliary muscle. In time accurate refraction and constant wear of glasses can manage all these problems.

Along with visual impairment, refractive errors are also a significant cause of morbidity besides having social and economic impact. Ammetropia results from an imbalance between the refractive power and the axial length of the eyeball.[7]

The multi-factorial nature of myopia and glaucoma poses a major challenge in understanding their mechanisms of pathology. Myopia is the most common human ocular disorder worldwide and is caused by abnormal growth of the eye resulting in refractive error.[8] Myopia also increases risk for other vision impairing diseases including glaucoma[9].

As prevalence of simple myopia is highest in Asia and commonly affects young and working age group. To prevent complications and to provide comfortable working ability, we have conducted this study which involves simple procedure of accurate refraction and will prevent so many persons from ill effects of myopia and loss of accommodation.

MATERIAL AND METHODS

By independent simple random sample selection technique total 65 patients from 15 to 35 years old of either sex having spherical myopia -1.0 to -4.0 D, and intraocular pressure 14 to 20 mm Hg, and wearing glasses for the first time were enrolled for study. Inclusion criteria were no sign of presbyopia, clear media, normal anterior chamber depth and Pakistani citizens by birth. After taking consent, patients were informed about duration and procedure of research. Initial refraction was done with auto-refractometer and then confirmed with retinoscopy and refined manually with cross cylinder for astigmatic correction and duochrome test for spherical correction to achieve equally readable in red and green at 6 meter for full correction of myopia. Inter pupillary distance, back vertex distance, and visual acuity were noted. Slit lamp examination of anterior and posterior segment was done. Intra-ocular pressure was measured with applanation tonometer. Full correction of myopia (equally readable in red and green on duochrome test at 6 meter) was prescribed and constant wear was advised. After one week, refractive correction was reconfirmed with glasses, and intra ocular pressure was measured immediately after removing the glasses. Further follow up was done after one month and three months, each time intra ocular pressure was measured immediately after removing the glasses, complaint if any was noted and results were compiled. Patients with incomplete follow up were not included in the data analysis.

RESULTS

Out of sixty-five patients, fifty two completed three months follow up. The demographic data of patients is given in table no: 1. Majority of our patients were females 40 (76.93%) and remaining 12 (23.07%) were males. Among these 52 patients reduction of IOP was observed in 45 (86.54%) patients, in remaining 7 (13.46%) patients there was no or little response. Initial

Table 1: Demographic data N 52.

Males	12 (23.07%)
Females	40 (76.93%)
Average age in years	22.45 (SD 1.3327)
Range of myopia	-1.0 to -4.0 D
Mean myopia	- 2.37 D
Standard deviation	1.07101

IOP of these patients was more than 18 mm Hg and their ages were more than 30 years. Only 10 (10.23%) patients complained of eye strain which was relieved after few days of wearing spectacles.

Mean intra ocular pressure before myopic correction was 17.2331 mm Hg with a standard deviation of 1.34931; mean intraocular pressure after full myopic correction was 14.3541 mm Hg with a standard deviation of 1.15210. Mean reduction of IOP was 2.8790 mm Hg (16.7062%) which is more or less equal to pilocarpine when used in open angle glaucoma. The results were therefore significant and p-value was 0.003 (< 0.05) when processed on SPSS versions 14.0. The summary of results is given in table 2.

Table 2: Summary of result after full myopic correction at 3 months follow up N = 52.

Females	40	76.93%
Males	12	23.07%
Mean IOP	14.3541	83.2937%
Mean reduction of IOP	2.8790	16.7062%
Standard deviation	1.15210	
P-value	0.003	

DISCUSSION

Aqueous humor dynamics depends on cilliary muscle and trabecular meshwork function which in turn are related with the refractive state of eye and play important role in regulation of intra ocular pressure. The prevalence of myopic refractive error is highest in the Asian population. An association between open angle glaucoma and myopia is well established, this relation is reported for children[10,11], in young adults[12] and presbyopic adults[13]. The relation between intra ocular pressure and myopia varies with age and ethnicity. We have done this study on younger age group between 15 to 35 years who were born in Pakistan and majority of these patients were females. Whether patient is myopic, presbyopic or dilated with potent cycloplegic, the ultimate effect is loss of cilliary muscle function and decrease in aqueous outflow due to decreased pull of longitudinal fibers of cilliary muscle, which are attached to scleral spur. Patients who do not show reduction in their intraocular pressure after full correction of myopia, they may have trabecular meshwork abnormality or ciliary muscle weakness.

Edwards and Brown reported that in children who were not myopic at age of 7 years but became myopic at the age of 9 years also showed increase in IOP and there was no change in IOP in non-myopic children over the same age and time period[14,15].

It is also observed that moderate myopes show greater increase in intra ocular pressure and higher peak values (19.8 mm Hg) as compared to emmetropes and low myopes (18.6 and 18.7 mmHg). This may be due to abnormal auto-regulation of ocular blood pressure in myopes of moderate and greater severity and can result in ocular hypertension or glaucoma[16]. Similar finding are observed in our study, patients who had myopia more than -2.0 D their intra ocular pressure was also more as compared to the patients having myopia less than -2.0 D.

Similar effects can be produced with cycloplegics which produce complete loss of accommodation and result in elevation of IOP in certain eyes in absence of angle closure. This type of response occurs in 23% with open angle glaucoma and 2% in normal individuals. Any patient who has normal anterior chamber angle and shows elevation of IOP after routine dilatation with potent cycloplegics should considered an open angle glaucoma suspect.[17].

It means normal accommodation plays important role in regulation of intra ocular pressure. This normal physiology is altered in myopia but can be returned to normal by accurate refraction in young persons. Full correction of myopia will keep the cilliary body muscle healthy and will delay the onset of presbyopia. Further more constant wear of accurate glasses can reduce IOP and in turn can limit the progression of myopia in young persons, prevents exophoria / exotropia, relieves head ache, and can delay onset of open angle glaucoma, because cillary muscle remains active. Under-correction of myopia not only ineffective in regulating the intra ocular pressure but also ineffective in controlling the progression of axial myopia[18]. Some studies have mentioned transient rise of IOP during early phase of accommodation but this occurs usually in animal models[19]. Two affects are produced with the myopia, defocusing of retina and decrease in accommodation[20], both these function are restored with full correction of myopia especially in young persons. The procedure of refraction is already being done since long time but no one has evaluated its effects on the physiology of eye. This is first time that we have noted these facts and prevented the young people from many complications of myopia by simple procedure that is full correction of myopia.

CONCLUSION

Accurate and full myopic correction plays important role in regulation of intra ocular pressure and aqueous humour dynamics. It can limit the progression of myopia, delay the onset of presbyopia and open angle glaucoma. It can prevent development of exophoria, exotropia, and related eye strains and headache. Therefore myopia should not be under corrected in young persons, as full correction is more effective in reducing IOP than under correction.

Author's Affiliation

Dr. Munawar Ahmed
Assistant professor, Department of Ophthalmology, Liaquat University of Medical and Health Sciences Jamshoro.

Dr. Murtaza Sameen
Liaquat University of Medical and Health Sciences Jamshoro.

Dr. Mahtab Alam Khanzada
Liaquat University of Medical and Health Sciences Jamshoro.

Dr. Arshad Ali Lodhi
Liaquat University of Medical and Health Sciences Jamshoro.

Dr. Azfar Ahmed Mirza
Liaquat University of Medical and Health Sciences Jamshoro

Role of Authors

Dr. Munawar Ahmed
Conducted the main research, examination of patients on each follow up visit, collection of data, and discussion with co-authors, compiled the results and written main script of the article.

Dr. Murtaza Sameen
Arranged spectacles for poor patients and helped in literature research.

Dr. Mahtab Alam Khanzada
Data collection and helped in main script writing.

Dr. Arshad Ali Lodhi,
Referred the patients who fulfilled the selection criteria to main author.

Dr. Azfar Ahmed Mirza
Counseling of the patients, and guided the patients about the research procedure.

REFERENCES

1. **Manik Goel, Renata G Picciani, Richard K Lee, Sanjoy K Bhattacharia**. Aqueous humor dynamics: a review Open Ophthalmol J. 2010; 4: 52-59.
2. **Yan Liu, Huibin Ly Xiaodan Jiang, Xiaodan Hu, Mingzhou Zhang, Xuemin Li.** Intraocular Pressure Changes during Accommodation in Progressing Myopes, Stable Myopes and Emmetropes PLOS One, 2015; 10 (10): e0141839.
3. **Kaufman PL, Ba´ra ´ny EH.** Loss of acute pilocarpine effect on outflow facility following surgical disinsertion and retrodisplacement of the ciliary muscle from the scleral spur. In the cynomolgus monkey. Invest Ophthalmol. 1976; 15: 793–807.
4. **Christina A. Esposito; Cody Peterson; Cory Coronado; Balamurali Vasudevan; Cenneth Ciuffreda.** Under-correction of myopia increases myopic progression –A retrospective study. Investigative Ophthalmology and visual science, 2012; 53: 4446. Doe:
5. **Balamurali Vasudevana, Christina Espositoa, Cody Petersona, Cory Coronadoa, Kenneth J. Ciuffredab.** Under-correction of human myopia – Is it myopigenic?: A retrospective analysis of clinical refraction data. J Optom. 2014; 7 (3): 147-52.
6. **A J Lee, S-M Saw, G Gazzard, A Cheng, and D T H Tan.** Intraocular pressure associations with refractive error and axial length in children Br J Ophthalmol. 2004; 88 (1): 5–7.
7. **Muhammad Zia-ul-Haque Ansari, Abrar Ali, Adnan Afaq, Tabassum Ahmed, Khawaja Sharif-ul-Hassan.** Relative distribution of refractive errors an audit of retinoscopic findings Pak J Ophthalmol, 2007; 23 (3): 144-150.
8. **Bloom RI, Friedman IB, Chuck RS.** Increasing rates of myopia: the long view. Curr Opin Ophthalmol. 2010; 21: 247–248.
9. **Loyo-Berrios NI, Blustein JN.** Primary-open glaucoma and myopia: a narrative review. WMJ, 2007; 106 (95): 85–89.
10. **Quinn GE, Berlin JA, Young TL, Ziylan S, Stone RA.** Association of intraocular pressure and myopia in children. Ophthalmology, 1995; 102: 180–5.
11. **Abdalla MI, Hamdi M.** Applanation ocular tension in myopia and emmetropia.Br J Ophthalmol. 1970; 54: 122–5.
12. **Edwards MH, Brown B.** Intraocular pressure in a selected sample of myopic and non myopic Chinese children. Optom Vis Sci. 1993; 70: 15–7.
13. **Nomura H, Ando F, Niino N, Shimokata H, Miyake Y.** The relationship between intraocular pressure and refractive error adjusting for age and central corneal thickness. Ophthalmic Physiol Opt, 2004; 24: 41-5.
14. **Edwards MH, Brown B.** IOP in myopic children: the relationship between increase in IOP and the development of myopia. Ophthalmic Physiol Opt. 1996; 16: 243–6.
15. **Ruth E Manny, G Lynn Mtchell, Susan A Cotter, Lisa**

A Jones-jordan, Robert N Kleinstein, Donald O Mutti et al. Intraocular Pressure, Ethnicity, and Refractive Error. Optom Vis Sci. 2011; 88 (2): 1445-1453.

16. **Xin Xu, Li Li, Ruidan Cao, Ye Tao, Qun Guo, Jia Geng, Yongzhi Li, Zuoming Zhang.** Intraocular Pressure and Ocular Perfusion Pressure in Myopes during 21 min Head-Down Rest ASEM, 2010; 81 (4): 418-422.
17. **Laurence S. Harris, MD.** Cycloplegic-Induced Intraocular Pressure Elevations: A Study of Normal and Open-Angle Glaucomatous Eyes. *Arch Ophthalmol.* 1968; 79 (3): 242-246.
18. **Kahmeng Chung; Norhani Mohidin; Daniel J.** O' Leary Under-correction of myopia enhances rather than inhibits myopia progression Vision research, 2002; 42 (22): 2555-2559.
19. **L Yan, L Hubbin, L Xuemin.** Accommodation induced Intra ocular pressure changes in progressing myopes and emmetropes Eye, 2014; 28: 1334-1340.
20. **Peter M. Allen, Daniel J.** O' Leary Accommodation functions: Co-dependency and relation to refractive error Vision Research, 2006; 46 (4): 491-505.