Original Article

Role of Topical Travoprost in Non Syndromic (simple) Axial Myopia in Young Persons

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Purpose: To evaluate the role of topical Travoprost 0.004% eye drops in reducing simple axial myopia in young patients.

Material and Methods: This case and control study was conducted on 45 young patients of either sex from 18 to 25 years old, who were selected by independent random sampling technique. Patients having best corrected visual acuity of 6/6 in both eyes, axial length more than 24 mm, myopia of -1.0 D to -4.0 D, and intraocular pressure of 16 to 20 mm Hg were registered for the study. After informed consent, slit lamp examination of anterior and posterior segment was done. Intra-ocular pressure and axial length were measured. Travoprost .004% eye drops were used in one eye once daily in the evening for four months. The fellow eye was kept as control. Follow up was done every month up to six months. On each visit best corrected visual acuity, axial length, and IOP were examined. Any complaint or complication was also noted and results were compiled.

Results: In these forty five patients reduction of myopia in treated eye was seen in 24 (53.33%), stabilization of myopia in 13 (28.88%), and increase in myopia was seen in 08(17.77%) patients. In these patients IOP 7.2445 mm Hg, axial length 0.2089 mm, and myopia -0.4444 D was reduced (P-value less than .05, as compared to fellow control eye where axial length and myopia increased by 0.1423 mm and -0.0478 D respectively. Despite IOP decreased by 1.0889 mm Hg. P-value was again less than .05. Temporary headache in 8 (17.77%), Conjunctival congestion in 16(35%) patients. Complication of darkening and lengthening of lashes were noted to variable degree in all treated eyes.

Conclusions: Topical Travoprost 0.004% eye drops is effective in reducing axial myopia in young persons.

Key words: Myopia, refraction, axial length, IOP, Travoprost eye drops, Young patients.

Myopic refractive errors are the most common eye conditions in the world. It is more common in whites than in blacks, in females than in males and more common in educated than illiterates[1]. Highest prevalence is observed in some East Asian populations reaching over 90%. Genetics clearly have an important role but type of visual environment also influences the onset, progression, and cessation of myopia[2].

Myopia can be physiological or pathological differentiated by the presence of degenerative changes and the level of the refractive error. Depending on age, myopia can divided into youth – onset (less than 20 years old), early adult-onset (20 to 40 years) and late

adult-onset myopia (above 40 years). Other classifications include: axial and non-axial myopia; low myopia (-0.25 to –3.0 D), moderate myopia (–3 to –6 D) and high myopia (–6.0 D). Myopia is also divided into syndromic and non-syndromic types. Non-syndromic myopia can be further divided into two types: myopia having complex traits which is determined by genetic and environmental factors; and myopia showing a mendelian pattern of inheritance (autosomal dominant, autosomal recessive), which is caused by genetic mutations[3].

Non-syndromic myopia typically begins in childhood, with the condition progressing throughout the high school and college years. Adults in the past didn't frequently develop myopia, but computer use seems to have increased the incidence of adult first time eye glass or contact lens wearers.

It is now widely accepted that the development of myopia is related to the genetic and environmental factors. Genetics plays a role in the growth of the eye and near work (especially reading) is important environmental factor that can result in myopia.

For both European and East Asian children, myopia is more common in the inner city region (8.1% and 55.1%, for European and East Asian, respectively)[4]. In young adults with moderate to severe myopia IOP increases at night, but level of the increase is significantly low than in the age-matched control subjects. Blindness due to malignant myopia is more common in persons living near the sea than in the persons living far away from sea coast[5]. Intra ocular pressure in upper normal limits (16 mm Hg or more) and weaker accommodation can result in progression of myopia in younger age group[6]. Reduction of IOP with anti-glaucoma drugs contributes in reduction of spherical myopic errors even after kerato-refractive surgery[7].

MATERIAL AND METHODS

This study was conducted in department of Ophthalmology, Liaqat University of Medical and Health Sciences, Jamshroo Hyderabad. In this control case study 45 patients were selected by independent random sampling method, 18 to 25 years old of either sex having best corrected visual acuity 6/6 in both eyes with normal appearing fundus, simple axial myopia from -1.0 to -4.0 D, Intra-ocular pressure 16-20 mm Hg, axial length more than 24 mm, were enrolled for study (Table 1). After informed consent complete slit lamp examination of anterior and posterior segment was done. Any intraocular pathology like stickler's syndrome, marfan's syndrome, ehler danlos syndrome, intraocular inflammation and media opacity were excluded. Best corrected visual acuity and IOP was noted, axial length was measured with A-scan and reading less than 0.1 standard deviation was noted.

Travoprost .004% (Travatan) eye drops were used once daily in the evening in more myopic eye with higher IOP, or in right eye in case of equal pressure in both eyes. Travoprost eye drops were used for four months. The fellow eye was kept as control. Follow up was done every month up to six months. After four months all patients were fully corrected for their refractive errors (equally readable in red and green on duochrome test) and travoprost was discontinued. On each visit visual acuity, refraction, axial length, and IOP were examined. Any complain or complication was also noted and results were compiled.

In results only 45 cases were considered who completed follow up for six months completely.

SPSS (Statistical Package for Social Sciences) version 14 was used to analyze the result of 45 patients who completed the recommended follow up period. Paired t-test was used to assess change in IOP, axial length and spherical myopia before and after treatment with travoprost on treated as well as on control eyes. For data analysis refraction was used in diopters after refining the refraction as full correction for far vision at 6 meters (equally readable in red and green on duoch-rome test). Independent sample test was performed to see significant difference before and after treatment.

RESULTS

Out of forty-five patients who completed required follow up; Travoprost eye drops were effective in reducing IOP, axial length and myopia in 24 (53.33%) patients in treated eye. In these patients whose initial IOP was 16-20 mm Hg; mean initial IOP was 17.7778 mm Hg standard deviation 1.14592. After one month reduction of IOP was 3 – 4 mm Hg (21 – 25%) (due to Travoprost) and after three to four months IOP reduced by 6 – 8 mm Hg (37.5% to 40.0%) to the base line IOP 10 – 12 mm Hg. After treatment the mean IOP 10.5333 mm Hg and standard deviation was 0.66058. Average reduction of IOP was 7.2445 mm Hg. This further reduction of IOP was due to active accommodation which resulted due to change in refractive status from under correction to over

correction of myopia for the far vision. Mean initial axial length in treated eye was 24.7778 mm and standard deviation was 0.14016. After treatment mean initial axial length was 24.5689 mm, standard deviation 0.12133, and average reduction of axial length was 0.2089 mm. Mean initial myopia in treated eye -2.7222 D standard deviation was 1.05828. Mean myopia after treatment was -2.2778 D, standard deviation 0.80697 and average reduction of myopia was −0.4444 D after four months treatment and maintained till last follow up at six months. There was significant reduction in myopia after treatment with travoprost. The results were two tailed and P value was less than 0.05 (Table 2).

In these 24 patients ocular refraction from myopia (under correction) changed to hyperopia (over correction) due to reduction in axial length and patient was complaining of eye strain. In these patients refraction was reviewed to full correction which relieved the eye strain.

In 13 (28.88%) patients reduction of IOP was 3 - 4 mm Hg and there was no change in axial length or refractive state of eye. In remaining 08 (17.77%) patients, increase in axial length (0.1mm) and myopia 0.25D was observed despite reduction of 3 - 4 mm Hg IOP. These patients were initially - 4.0 D myopic.

In the fellow control eyes initial mean IOP 17.5111 mm Hg and standard deviation was 1.17980. After six months mean IOP was 16.4222 mm Hg, standard deviation 1.35661, and average decrease in IOP was 1.0889 mm Hg. Initial mean axial length 24.7733 mm and standard deviation was 0.12804. After six months mean axial length 24.9156, standard deviation 0.11763 and increase in axial length was 0.1423 mm. Initial mean myopia -2.6833 D, and standard deviation was 1.01326. After six months mean myopia -2.7311D, standard deviation 1.06958 and increase in myopia was -0.0478D mainly during early follow up period. Increase in axial length and myopia was more common in patients under 20 years of age. Fellow eye acted as partially control eye due to reduction of IOP because of systemic absorption of travoprost eye drops. Even then this increase was significant and p-value was less than 05 (Table 3).

In treated eye best corrected visual acuity improved (from 6/6 to 6/5 partial) in 15 (33.33%) patients than in fellow (control) eye, the reason is not known, it might have increased retinal circulation.

Conjunctival congestion in treated eye (Fig. 1) and to lesser degree in fellow eye was noted in 16 (35%) of patients which decreased within two month. Conjunctival congestion in the fellow eye was due to systemic absorption. Temporary headache occurred in 8 (17.77%) patients. Complication of darkening and lengthening of lashes was noted to variable degree in all treated eyes (Fig. 2). No case of macular edema in these young patients was seen.

Table 1: Demographic information of patients

Male	09
Female	36
Range of age	18-25
Present residency	Urban
Range of refractive error	−1.0 D to −4.0 D
Education	students of class XII to university level
Socioeconomic	Poor to middle class

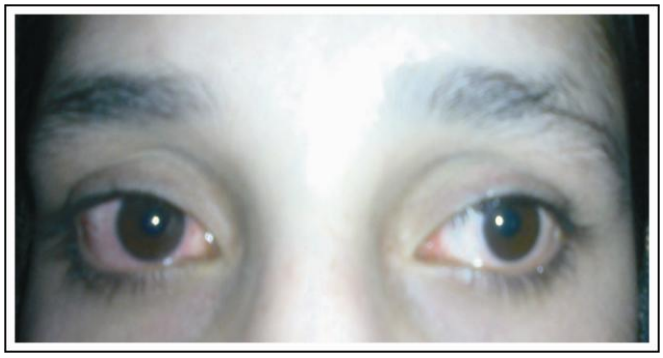

Fig. 1: Travoprost used in right eye (Conjunctival congestion in both eyes)

Fig. 2: Lengthening of eye lashes in right eye after 4 months use of Travoprost

Table 2: Effects of topical travoprost 0.004% eye drops

Eye Under Treatment			
Varaiables	**Before Treatment**	**After Treatment**	**Change**
• Average IOP	17.777 mm Hg	10.53 mm Hg	↓7.24 mm Hg (40.74%)
• Average axial Length	24.777 mm	24.56 mm	↓0.21 mm (0.847%)
• Average myopia	-2.722D	-2.27D	↓-0.45D (16.540%)
Control Eye			
• Average IOP	17.511 mm Hg	16.442 mm Hg	↓1.088 mm Hg (6.17%)
• Average axial L	24.773.0 mm	24.956 mm	↑0.1422 mm (0.56%)
• Average myopia	-2.683	-2.731	↑-0.0478D (1.86%)

Table 3: Outcome of treatment with travoprost 0.004%

Effect	**Treated Eye n 45 (%)**	**Control Eye n 45 (%)**
Reduction in myopia	24 (53.33)	0.00 (0.00)
Control of myopia	13 (28.88)	0.00 (0.00)
Increase in myopia	08 (17.77)	45.0 (100%)
Increase in BCVA	15 (33.33)	0.00 (0.00)
Reduction of Axial length	24 (53.33)	0.00 (0.00)
Lengthening of eye lashes	45 (100)	0.00 (0.00)
Conjunctival congestion	11.0 (24.44)	11.0 (24.44)

DISCUSSION

Trend in the change of lifestyle, increased educational competition in younger age students, and relatively high IOP is increasing the incidence of myopia. Variable accommodation also plays important role in lowering the intraocular pressure. When accommodation is totally relaxed in myopic persons, mainly when myopia is more -2.0D, aqueous out flow through trabecular meshwork is decreased resulting in slight increase in intraocular pressure. If this change of IOP occurs at younger age it stretches the immature eye ball tissue, increases axial length, and myopia. Mean refractive shift per year in myopic children is −0.30 D/yr. Reduced ocular rigidity, increased wall stress due to relatively high intra-ocular pressure, and scleral thinning play important role in myopia progression in young persons[8]. The average intraocular pressure in twenty four hours is slightly high in the myopic than in emmetropics[9].

Although most of the refractive errors can be corrected by optical or surgical methods, but these methods cannot stop or retard the progression of myopia. These treatments also have some drawbacks and pose a large economic burden.

Travoprost 0.004% has no affect on ciliary body muscle in relation to contraction or relaxation as it does not affect aqueous production, and has no effect on nutrition of intraocular structures. Travoprost increases uveoscleral out flow and its maximum stable affect (25% – 30%) is achieved within two weeks. In our study 40% reduction of intraocular pressure was observed. This reduction of IOP was in two steps; in first 15 days intraocular pressure was reduced due to travatan, and in second to third month of treatment further reduction of intraocular pressure was due to active accommodation within 6 meter distance. When eye under treatment, became 0.25D to 0.5D hyperopic due to decreased IOP and axial length and further 10-

15% reduction of IOP was observed.

Patient also felt heaviness in eye under treatment due to mild hyperopia and the refraction was then under corrected on duochrome test. Again 10-15% IOP increased. It was also observed that target pressure between 10 – 12 mm Hg is required to reduce the myopia and 14.0 mm Hg target IOP required to stop its progression. Role of active accommodation have also been observed by other researchers. In the fellow control eye 2-3 mm Hg reduction of IOP was also observed but this small reduction did not reduce the axial length or myopia but progression of myopia was reduced. This reduction of IOP in fellow eye was due to systemic absorption. Change in near work habit, full correction of refractive error, and lowering of IOP with travatan eye drops can control or reduce axial myopia. It has also been observed that intra-ocular pressure is lowered more after repeated accommodation than after static accommodation. Pattern of near work therefore also affects intra-ocular pressure[10].

The developing eye experiences a number of changes that lead to adjustment of its optical components in accordance with the natural trend to emmetropia and the sometimes conflicting intervention of environmental influences. It is well established that central corneal thickness also affects IOP measurements.

IOP was also found to be associated with amplitude of accommodation but only in males. As the amplitude of accommodation is known to decrease with age and the IOP was shown to rise in the first decade of life. The fact that males and females vary in significance of associations between IOP and amplitude of accommodation may result from the differences in the IOP changes with age and the deviation of the trends after 12 years of age. Differences between males and females have been noted by Pensiero but the greatest deviations were noted before the age of 6 in the previous study[11].

Mean IOP is higher by 3 mm Hg in myopic than in emmetropic eye. Therefore, relatively elevated IOP (16 or more) and poor accommodation can be the risk factor in myopia progression in young age group[12]. In pathological myopia, continuous thinning occurs in the sclera, choroid (from 250 to <10 µm), and secondary defects in the Bruch's membrane, loss of retinal pigment epithelium, choriocapillaris, and retinal photoreceptors with maximal thinning observed at the posterior pole[13].

CONCLUSIONS

Topical Travoprost and full correction of refractive error is effective in reducing axial myopia. It is therefore recommended that myopia should be fully corrected for the far vision to facilitate aqueous out flow to maintain target IOP (10 – 12mm Hg) which if maintained at early age can prevent progression of myopia in young persons.

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Role of Authors

Dr. Munawar Ahmed
Conducted the main research guided and informed the patients about the research procedure, it's duration, number of follow up, and it's beneficial and possible worse effects. Observation of effects and side effects of drug used for research purpose and compiled the results and discussed with the second author.

Prof. Muhammad Arshad Mahmood
Partially conducted the research on some patients adopting the same research protocol, helped in writing and compiling the results.

Dr. Atif Mansoor Ahmed
Provided guide lines about research procedures and selection of patients.

Dr. Murtaza Sameen
Helped in data collection and arranged the drug used for research.

Dr. Arshad Ali Lodhi
Helped in literature search.

Dr. Noman Ahmed
Helped in data collection and informed the patients about research procedure.

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