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Indian Journal of Clinical and Experimental Ophthalmology

Journal homepage: www.ijceo.org

Original Research Article

Regression of mild myopia using extended blinking therapy

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ARTICLE INFO

Article history:
Received 10-12-2023
Accepted 31-07-2024
Available online 30-12-2024

Keywords:
Myopia
Extended blinking
Visual acuity

ABSTRACT

Aim: Objective of this study was to assess whether extended blinking exercises have any role in the improvement of vision and halt the progression of myopia.
Materials and Methods: This is a prospective comparative study, done over a period of 1 year. Mild myopic patients, with spherical equivalent upto – 3 D myopia, aged 11-40 years were included. 80 myopic patients (160 eyes) were divided into 2 groups (cases and controls) with 40 patients in each. Cases were subjected to extended blinking exercises, while the control group were given glasses. After 6 weeks - visual acuity, cycloplegic and subjective refraction and biometry was observed in both groups.
Result: 80 myopic eyes (cases) had improvement of visual acuity in right eye from 0.28(logmar) to 0.07(logmar) which is of high statistical significance. The spherical equivalent decreased from -0.70 ±0.45 D to -0.22 ±0.34D. The left eye visual acuity improving from 0.29 (log Mar) to 0.06 (logmar) which is also of high statistical significance. The spherical equivalent decreased in the left eye from -0.7 ±0.45D to -0.2± 0.32 D. Out of 80 eyes (cases) 50 eyes became emmetropic whereas there was significant improvement of increased visual acuity in the rest. Controls had no significant change in any of the parameter.
Conclusion: This study concludes that simple diurnal extended blinking exercises is quite an effective strategy in regressing, thus halting the progression of myopia at an early stage.

1. Introduction

There are multiple factors responsible for our vital sense of sight, ranging from clarity of the media to the biometric parameters, a good retinal sensitivity and a smooth functioning of the extraocular muscles. WHO has identified refractive errors as one amongst the five major blinding conditions that requires immediate attention. Myopia has been noted to be a major refractive error contributing to the burden of avoidable blindness. With an increasing prevalence of myopia, it is proving to be a global pandemic.

The prevalence of myopia varies across countries between 10 and 30%. In India, this prevalence varies according to different study settings like in community-based settings; it has been recorded between 4 and 10%, while, in school-based studies, it has been recorded between 10 and 20%. By 2050 more than half the world's population is going to be affected by myopia along with its vision threatening consequences.

Myopia has been corrected with the help of spectacles and refractive surgery. However, ocular exercises and yoga have been a debatable topic for correction of myopia. At a physiological level, it was discussed by Bates long back in early 1900s, that extraocular muscles have a role to play in vision and ocular exercises that relieve the strain

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https://doi.org/10.18231/j.ijceo.2024.126

on extraocular muscles.[1] However, the role of exercises in improvement of vision has been refuted by most of the studies. A symptomatic improvement due to yogic ocular exercises like palming, blinking, etc., has been noted.

The present question of research study is whether the known exercises have any role in the improvement of vision and whether any simple ocular intervention can on long term decrease or halt the progression of myopia or in more specific terms regress the myopia to emmetropia without any side effects or toxicity.

This study tries to answer the above question and provide answers to the validity of simple blinking exercise in the control of myopia.

2. Materials and Methods

This is a prospective comparative study, done in a tertiary care hospital in Eastern India over a period of 1 year. Mild myopic patients, with refractive error of spherical equivalent upto – 3 D, aged 11-40 years consenting for the study were included. Patients with any known ocular or systemic diseases and non-consenting patients were excluded from the study. The purpose and procedure of study was explained to all the participants. A written informed assent and consent were taken as per the Declaration of Helsinki.

80 myopic patients (160 eyes) were divided into 2 groups (cases) and (controls) with 40 patients (80 eyes) in each group. The purpose and procedure of study was explained to the subjects. The first group was subjected to extended blinking exercises, while the second group was given only conventional treatment with spectacles. Eye exercise was done without wearing glasses. At other times the control subjects were wearing glasses as per Ophthalmologist's prescription.

After 6 weeks - visual acuity, cycloplegic refraction and biometry was observed in both groups. Spherical equivalent refractive error was calculated and results were compared and analysed statistically.

The extended blinking exercise advised was - Opening both the eyes and looking at a far distance for 5 seconds. Thereafter eyes are gently closed for 5 seconds. Repeat of this cycle of blinking exercise for 5 minutes in the morning and 5 minutes in the evening was done by the cases. Subject was instructed to stop the exercise immediately if any discomfort is felt and report.

The visual acuity was carried out using the logmar vision chart. The unaided vision was recorded. Refraction value was obtained by subjective refraction done by one and same refractionist only. With subsequent visit the data was saved in files electronically and compared with the previous data. The near vision, distant vision aided, unaided and pinhole was documented. Patients with 6/6 vision were included. The standard near vision was N6 in both eyes.

The keratometry values was measured by IOL MASTER of which the average of both vertical and horizontal keratometry was converted to mean K in both right and left eye separately and was recorded. This was done for both right and left eye in each visit. NPA and NPC were also noted Fundoscopy was done in each subject to rule out any abnormality in every visit.

3. Results

The following are the results of the study in the tabulated form for both the eyes in cases and controls.(Table 1)

There was no statistically significant difference between the age groups in cases as compared to control.(Table 2)

Cases and controls showed no gender related significant difference.

The visual acuity is measured in logmar units. The pre-exercise and post-exercise show significant change in visual acuity with corresponding change in refractive error (spherical equivalent) in both the right eye and left eyes.(Table 3) The other parameters have no change of significance.(Table 4)

4. Discussion

Myopia is one of the refractive errors which is now proving to be a global burden. The digital education which started in the times of COVID and an indoor confinement of children, led to a radical rise in onset of myopia in children with a drastic increase in progression. With this increased use of digital devices, an increase in prevalence of myopia amongst children has also been noted. An onset of myopia in early age carries the risk of many other ocular diseases that might follow along, like glaucoma, macular degeneration, retinal detachment, cataract, etc.[2] All this threatens to decrease the productive life years and thereby add to the economic burden, not just in the form of pharmacological and surgical treatment, but also as non-pharmacological treatment like optical devices.

Yogic eye exercises like Palming, Blinking, Sideways viewing, Rotational viewing, near and distant viewing etc have been studied to be effective in reducing ocular fatigue. Yoga ocular exercises have been studied to be dynamic or isotonic exercises of extraocular muscles, wherein repeated stretching of EOM has been seen to improve ocular fatigue and reduce ocular strain. Similarly, the levator palpebrae superioris and orbicularis oculi muscles are involved in blinking and exercise of these muscles have been hypothesized to improve the visual acuity in myopes.[3,4]

Present study involves an exercise in which there is cyclic repetition of opening and closing of both eyelids for a period of 5 seconds. The total time period of the exercise has been assigned for a period of 5 minutes diurnally. This similar kind of exercise of blinking have been stated in other studies too, but the diurnal variation of this study is of significant importance. The exercise of blinking has been of therapeutic interest in progression of myopia in computer

Table 1: Mean age of case and control

	Case		Control		P Value
	Mean	Std. Deviation	Mean	Std. Deviation	
Age (years)	18.80	4.13	19.00	4.66	0.836

Table 2: Gender comparsion between case and control

			Group		P Value
			Case	Control	
Gender	Male	N	15	12	0.584
		%	37.5%	30%	
	Female	N	25	28	
		%	62.5%	70%	

Table 3: Comparsion of variables in pre and post exercise

Case	Pre exercise		Post exercise		P Value
	Mean	Std. Deviation	Mean	Std. Deviation	
VA_R	0.28	0.17	0.07	0.12	<0.001
SPH-EQ_R	-0.70	0.45	-0.22	0.35	<0.001
KR	44.17	1.41	44.20	1.37	0.127
AXL_R	23.25	0.79	23.28	0.80	0.246
VA_L	0.30	0.18	0.06	0.13	<0.001
SPH-EQ_L	-0.68	0.45	-0.20	0.33	<0.001
KL	44.12	1.45	44.12	1.42	0.932
AXL_L	23.24	0.78	23.26	0.76	0.287

VA R: Visual acuity in right eye; SPH-EQR: Spherical equivalent in right eye; KR: Mean keratometry in right eye; AXL_R: Axial length in right eye; VA L: Visual acuity in left eye; SPH-EQ L: Spherical equivalent in left eye; KL: Mean keratometry in left eye; AXL_L: Axial length in left eye

Table 4: Comparision between first and last visit of visual parameters

Control	First Visit		Last Visit		P Value
	Mean	Std. Deviation	Mean	Std. Deviation	
VA_R	0.45	0.34	0.44	0.36	0.375
SPH-EQ_R	-1.40	1.02	-1.38	1.08	0.645
KR	44.50	1.43	44.58	1.43	0.056
AXL_R	23.46	0.91	23.47	0.91	0.824
VA_L	0.42	0.32	0.42	0.34	1.000
SPH-EQ_L	-1.12	0.91	-1.19	1.13	0.666
KL	44.61	1.46	44.60	1.47	0.834
AXL_L	23.31	1.04	23.39	0.93	0.304

VA R: Visual acuity in right eye; SPH-EQR: Spherical equivalent in right eye; KR: Mean keratometry in right eye; AXL_R: Axial length in right eye; VA L: Visual acuity in left eye; SPH-EQ L: Spherical equivalent in left eye; KL: Mean keratometry in left eye; AXL_L: Axial length in left eye

vision usage along with its other complications. Most of the exercises focus on the single entity of retarding the progression of myopia with questionable effect,[5] but this study not only halts progression but regresses the myopia along with increasing visual acuity bilaterally than baseline and thus there was reduction of refractive error specially myopia.

In a study by B liang et al proved a minimal improvement of myopic progression with ocular exercise without any definitive mechanism of cause of improvement. Moreover there was no control group in this study.[6] Previously, many studies by Mutti D, Koslowe K.C. and others have noted that there isn't any statistically significant improvement in visual acuity with the help of ocular exercises.[7,8] Similarly in 2014, it was issued by American Academy of Ophthalmology that there isn't adequate scientific data to prove an improvement in vision with any vision training or therapy. Most of the studies that worked on myopia or its progressive variant doesn't elucidate on the significant effect of the interventions on the final outcome as much as most of them conclude as to a very minimal or statistically no significance of change in refractive error or improvement of visual acuity in all of its characteristics. Due to its unavailability of data or significant scientific evidence the American Academy of Ophthalmology clearly negates the effects of visual exercises or training protocols for any

development in the visual status.

Our studies worked on two groups of 80 myopic eyes (cases) and found an important finding in the relative improvement of vision from 0.28 (logmar visual acuity) to 0.07 (logmar visual acuity) which is of high statistical significance. Similarly the spherical equivalent decreased from -0.70 ±0.45 D to -0.22 ±0.34D. The left eye also had similar findings with the visual acuity improving from 0.29 (log Mar) to0.06(logmar) which is of high statistical significance. The spherical equivalent decreased in the left eye from -0.7 ±0.45D to -0.2± 0.32 D. Out of 80 eyes in study group (exercise) 48 eyes attained emmetropia whereas there was significant improvement of vision and increased visual acuity in the rest. This was a similar finding found in both the eyes without any kind of differential behaviour. There was no improvement in the vision nor there was any decrease of refractive error in the control group.

Certain studies have shown a modest effect on reduction of progression of myopia, but not an improvement in visual acuity. Similarly a 55% decrease in the rate of progression of myopia with the help of optical interventions like spectacles and contact lens has been found in previous study by Gupta Rakesh.[9] Use of low dose atropine has currently been in practice for controlling the progression of myopia with its own side effects and long term use complications. The regression of myopia is not determined and there is no improvement of vision in the trial. Our study is a simple technique of blinking therapy which is an extended form without any therapeutic drugs thus avoiding the potential side- effects. The present study had all the patients having improvement of vision with no undue adverse events or exercise related complications in any patient. The near vision, colour vision all had the same normal values.

However an improvement in vision has been noted in studies by abdel rehman, K. Lekshmi, Gosawade Nitin et al and many other studies.[10–12] The drawback in all the studies being a lack of clear scientific methodology and demonstration of visual parameters. In the above studies there is no reliability as per the data involving the improvement of vision, and the scientific methodology parameters are not well documented. The improvement doesn't quantify or qualify the exact refractive status or its after effects in the domain of visual acuity indices.[13] Thus there being not much study on this aspect explaining or ascertaining the improvement of myopia, the present study is an innovative study method in context to myopic control and its regression.

In our study a statistically significant improvement in visual acuity was found after 6 weeks of blinking exercises. While 60% of subjects achieved an improvement to complete emmetropia, rest 40% showed a high significant regression in the extent of myopia. Improvement was noted in both the eyes. However, no improvement was seen in the control group.

While keratometric parameters have not been studied intensely in previous studies, a thorough evaluation of K1 and K2 revealed no changes either in the study (cases) or the control group. Keratometric changes (mean k) didn't vary significantly in both cases and controls in both first and last visit measurement signifying of nil statistical significance. There has been some individual keratometric changes but on the whole it's not of significance. This is affirmed by the fact that no statistically significant change in axial length was found. Some differences in axial length could also be due to measurement error both manual and machine using (IOL master) factors. Based on the nil changes of biometric parameters we deduce that there could be a change in the retinal sensitivity which encompass all the stimuli in a more effective way. The increased retinal sensitivity could improve vision as such found in amblyopia therapy where the retinal stimulation causes increased sensitivity of vision. In such cases there is also no biometric change but there is evidence of improvement of vision. Other possible mechanism could be the simultaneous stimulation of both the retina and the brain functions.[14] To term the exact location of the complex visual adaptation couldn't be feasible with the available manpower, resources and the neurophysiological expertise in our setup which is a lack in this study.

The NPC (near point of convergence) and NPA (near point of accommodation) was not of much statistical significance in both the cases and controls in the present study. Rathod et al suggests that there is decrease in the near point of convergence by some ocular exercise having questionable role in the improvement of mild vision.[15] As quoted by other researchers accommodative exercises do help in reducing asthenopic symptoms but improvement of vision is a question still. Our study doesn't provide any insight into this effect of accommodative exercises on visual improvement.

Nevertheless, certain limitations in our study, like a small sample size, short duration of follow-up and inclusion of mild myopia cases, needs us to extend our pilot study to a larger sample size with varying degrees of myopia. More neurophysiological research is indeed needed to locate the exact mechanism in a more multiracial, socioeconomic and larger and vaster demographic profile.

5. Conclusion

This present study concludes that simple diurnal blinking exercises is a quite an effective strategy in halting the progression and thus regressing myopia at an early stage thus decreasing the burden of myopia in young children and adults.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Cite this article: Mohanty SK, Dash S, Padhee S, Sahu PP. Regression of mild myopia using extended blinking therapy. *Indian J Clin Exp Ophthalmol* 2024;10(4):723-727.