Short Communication

Effect of Yoga Ocular Exercises on Eye Fatigue

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Abstract

Background: Comfortable working at near and intermediate tasks depend on the efficiency as well as coordination of accommodation and vergence systems. At present, the need for near and intermediate visual tasks has been dramatically increased, requiring prolonged computer- and gazette-related works. It demands excessive working of the extraocular and ciliary muscles. It may cause eye fatigue and other associated asthenopic symptoms. Globally, eye fatigue is one of the most commonly reported conditions in nonpresbyopic population with asthenopic symptoms. It is necessary to get relief from eye fatigue for better near and intermediate tasks. **Materials and Methods:** Thirty-two undergraduate optometry students who were symptomatic based on a validated eye fatigue questionnaire were included after a baseline comprehensive eye examination. Based on the eye fatigue symptoms score, they were equally assigned to a control group and an exercise group with sixteen participants in each. The exercise group performed yoga ocular exercises for up to 6 weeks after which the eye fatigue symptoms were reassessed in both groups. **Results:** In the exercise group, there was a statistically significant reduction in eye fatigue scores (P = 0.003), whereas the eye fatigue scores showed significant increment in the control group after 6 weeks (P = 0.044). **Conclusions:** Yoga ocular exercises reduce the eye fatigue symptoms score by increasing the efficiency of extraocular muscles. Hence, it could be considered as a therapeutic and nonpharmacologic intervention for reducing the eye fatigue and associated asthenopic symptoms.

Keywords: *Accommodation, asthenopia, eye fatigue, vergence, yoga ocular exercises*

Introduction

Eyes are one of the vital sense organs, on which an individual's day-to-day living activities are directly or indirectly dependent. If sleep duration is disregarded, a substantial range of visual perception and information is perceived by an individual through his/her eyes, both at home and workplace.[1] Comfortable working at near and intermediate tasks depend on the efficiency as well as coordination of the accommodation and vergence systems.[2] In today's dynamic world, need for near and intermediate visual tasks has been dramatically increased, requiring prolonged computer and gazette-related works and reading books. It demands excessive working of the extraocular muscles (EOMs) (vergence) and ciliary muscles (accommodation) which may cause eye fatigue which in turn may lead to other associated asthenopic symptoms.[3] Globally, eye fatigue and asthenopic symptoms are the most commonly reported conditions in a nonpresbyopic population and are highly significant.[2,3] Most of the people complain of ocular visual discomforts such as asthenopia, headache, tired eyes, eye strain, dry eyes, eye irritation, blurring of vision, burning sensation, redness, and diplopia,[4] that impair the efficiency of near and intermediate tasks.[2] In the present context, college and university students are extensively exposed to an accelerated environmental eye fatigue as being frequent computer and other visual display users. Eye fatigue can be triggered by various aspects such as artificial or deficient lighting condition (poor visual hygiene), prolonged watching of visual displays, malnutrition, poor working and inefficient EOMs, prolonged working hours at working place and academic tasks, psychosocial and emotional status, stress, and aging.[5] Proper diagnosis and treatment plan should be done along with exercises and adequate diet plan to improve the quality of life of patients, otherwise may lead to strabismic anomalies and various other complications.[2,3]

Eye fatigue is commonly associated with functional defects in EOMs resulting often

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from various near tasks.[5] Therefore, muscles relaxation practices may aid relieve eye fatigue symptoms. Yoga practices have shown to be associated with physical as well as mental health benefits through downregulation of the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system.[6] Further, studies have suggested that yoga eye exercises are believed to improve ocular motility and help to relieve symptoms of asthenopia and eye fatigue.[1,7] Various yogic websites, online yoga videos, and many yoga practitioners suggest simplified practices of yoga exercises and their benefits on eyes. There are claims of improvement of the visual system, coordination of two eyes, and refractive error. Definitive studies regarding this in literature are lacking. Hence, this study was designed to check if yoga ocular exercises could be an important tool to reduce eye fatigue and associated asthenopic symptoms.

Materials and Methods

This prospective study was done by enrolling the optometry college students in Bengaluru, India. After obtaining permission from college and hospital authorities in accordance with the tenets of the Declaration of Helsinki, informed consent was obtained from each student. Students with best-corrected visual acuity better than or equal to 20/20 (6/6) and are symptomatic based on a validated eye fatigue questionnaire were only included in the study. Students with a systemic or ocular pathology, ocular surgery, high ametropia (≥ ± 6.00 D), any strabismic anomaly, or undergoing any kind of vision therapy were excluded from the study. Two groups (sixteen in each) were divided in such a way that there was no significant difference in the baseline eye fatigue scores [$P = 0.928$; Table 1] as well as in the categorization of eye fatigue scores into mild, moderate, and severe [$P = 0.544$; Figure 1] between both groups.

Eye fatigue was subjectively measured using a validated questionnaire[8,9] in which the level of eye fatigue was scored using a 7-point Likert scale (0 = none, 1 or 2 = slight, 3 or 4 = moderate, and 5 or 6 = severe), assessing the source of eye fatigue from 12 items: tired eyes, sore/aching eyes, congested/red eyes, irritated eyes, watery eyes, dry eyes, eyestrain, hot/burning eyes, blurred vision, difficulty focusing, double vision, and visual discomfort.[9] A higher score indicates a higher level of perceived eye fatigue.

A trained yoga instructor guided the participants in the exercise group only to perform yoga ocular exercises for 30 min/day for 5 days/week. Each session of yoga ocular exercises involved the following ten steps in a sequence**:** palming, blinking, sideways viewing, front and sideways viewing, diagonal viewing, rotational viewing, preliminary nose tip gazing, near and distant viewing, concentrated gazing, and acupressure point on the palm.[5,10] After 6 weeks, the eye fatigue scores and its level were reassessed subjectively using the same questionnaire to evaluate the changes if any.

The data input and statistical analysis were done using the International Business Machine Statistical Package for the Social Sciences (IBM SPSS Statistics) V 23.0 for Microsoft Windows developed by the IBM Corporation, USA.

Results

The mean age of control group and exercise group was 20.94 ± 1.72 years (18–24 years) and 21.13 ± 1.70 years (19–24 years), respectively, with 7 males and 9 females in each [Table 1].

There was a statistically very high significant difference in the eye fatigue scores after 6 weeks between two groups ($P < 0.001$), which was insignificant during baseline measurements between two groups ($P = 0.928$) as shown in Table 1.

Figure 2 (paired *t*-test) shows that the exercise group had a mean baseline eye fatigue score of 16.38 ± 6.27 of 72 which significantly reduced up to 9.88 ± 4.93 after 6-week period ($P = 0.003$). The control group had a mean baseline eye fatigue score of 16.19 ± 5.30 of 72 which significantly increased up to 19.06 ± 7.87 after 6-week period ($P = 0.044$).

Figure 1 (independent sample *t*-test) shows that overall, there was a statistically insignificant difference in the categorization of eye fatigue between two groups during baseline measure ($P = 0.544$). However, there was a statistically significant difference in the categorization of eye fatigue between two groups after 6 weeks ($P = 0.003$). Hence, it indicates a statistically significant improvement in the severity of eye fatigue level, and there was a dramatic increase in number of asymptomatic participants in the exercise group after 6 weeks.

Discussion

The results from the current study indicate that after 6-week follow-up, there was a significant reduction in the scores of eye fatigue and asthenopic symptoms in the exercise group involving the application of EOMs. In addition, participants in the exercise group had a significant decrease

Table 1: Clinical characteristics and baseline eye fatigue of the participants: Mean±standard deviation

Group	Mean age (years)	Gender (male:female)	Mean BCVA (LogMAR)	Use of visual media per day (h)	Duration of near work per day (h)	Sleep duration per day (h)	Baseline eye fatigue scores (out of 72)	*P* for baseline eye fatigue scores
Exercise group	21.13±1.70	7:9	1.00±0.00	5.19±1.94	5.88±2.33	7.06±1.06	16.38±6.27	0.928*
Control group	20.94±1.72	7:9	1.00±0.00	4.25±1.73	4.94±2.48	7.38±0.80	16.19±5.30	

*P=Not statistically significant (P>0.05). LogMAR=Logarithm of the minimal angle of resolution, BCVA=Best-corrected visual acuity

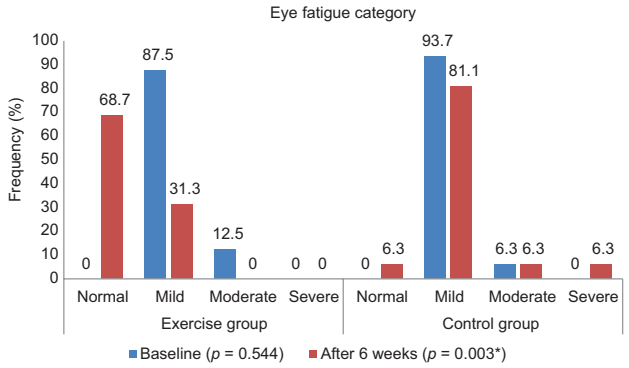

Figure 1: Comparison of categories of eye fatigue between exercise and control group

Group	Category of eye fatigue	Baseline % (*P*=0.544)	After 6 weeks % (*P*=0.003*)
Exercise group	Normal	0	68.7
	Mild	87.5	31.3
	Moderate	12.5	0
	Severe	0	0
Control group	Normal	0	6.3
	Mild	93.7	81.1
	Moderate	6.3	6.3
	Severe	0	6.3

**P*=Statistically significant (*P*<0.05)

in eye fatigue levels over 6-week period, whereas those in the control group had an increase in eye fatigue levels. These findings are similar to previous studies that reported yoga ocular exercises significantly decreased eye fatigue and visual discomfort score of participants working in a software company.[4] Yoga ocular exercises also caused a significant reduction in eye fatigue level in medical college students with refractive error[7] as well as in undergraduate nursing students.[1] A previous study has also suggested that a yoga program should include yoga postures, breathing, joint exercises, visual-cleansing exercises, and relaxation.[4]

It is also believed that activities during yoga ocular exercises invigorate EOMs to work more efficiently. Besides it also emboldens the blink reflex and stimulates the aqueous humor circulation, which helps in the nourishment of the ocular tissues. The mechanism of efficient working of EOMs and stimulation of aqueous humor flow due to these exercises can be complex. There is constant movement of eyes during day and reduced movement at night. While practicing yoga ocular exercises, the bulbomotor muscles are maximally and continuously stretched in all directions that dramatically increases metabolic demand (oxygen consumption) of muscular tissues.[11] Yoga ocular exercises can be referred to as isotonic/dynamic exercises of EOMs (skeletal muscles), where both concentric contraction (shortening) and eccentric contraction (elongation) of EOMs occur.[12] Regular exercise of skeletal muscles trains them to be able to undertake the exercise more efficiently. Surprisingly, it has recently been

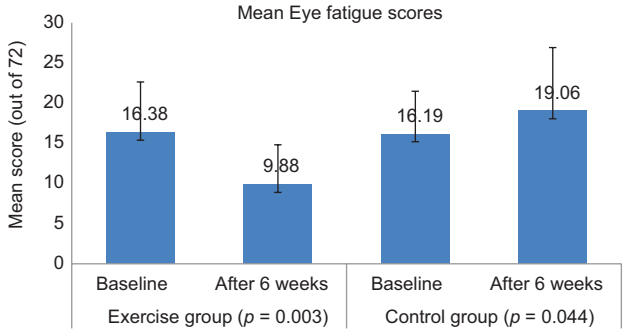

Figure 2: Comparison of mean eye fatigue scores between exercise and control group

Group	Duration	Mean score (of 72)±SD
Exercise group (*P*=0.003)	Baseline	16.38±6.27
	After 6 weeks	9.88±4.93
Control group (*P*=0.044)	Baseline	16.19±5.3
	After 6 weeks	19.06±7.87

SD=Standard deviation

shown that much milder repeated eccentric contractions where elongation of muscle is slow can be an efficient way of increasing muscle strength.[13] Hence, it is believed that EOMs get stronger which in turn invigorates the muscles to work more efficiently. On the other hand, concentric and eccentric contraction of EOMs lead to an increment in intraorbital blood circulation which acts as a pump for a more efficient intraorbital venous outflow.[14] Furthermore, palming may have a vasodilatory effect on episcleral veins and thus trigger circulation and outflow of aqueous humor, which helps in proper nourishment of ocular structures in the anterior segment.[11] The levator palpebral superioris and orbicularis oculi are responsible for blinking mechanism. Motor control of levator muscle is through the oculomotor nerve which is identical to the innervation of EOMs (except superior oblique and lateral rectus).[15] Like EOMs, both levator and orbicularis are striated muscles[16] and work in conjunction with EOMs during yoga practice. Hence, blinking exercise (rapid and voluntarily)[5] increases the working efficiency of levator and orbicularis, stimulating blinking mechanism and thus resulting the blink reflex to become more spontaneous.

Besides the ocular effects of yoga, the differences in eye fatigue scores between two groups may also be influenced by the psychological benefits gained by participants in the exercise group from attending regular yoga sessions. This supports the concept that psychological effects could be an additional factor in the exercise group.[4]

Further studies are required evaluating the effects of yoga ocular exercise involving larger populations of different age groups, and binocular vision anomalies are necessary to establish the potential benefits of yoga ocular exercise for the prevention and treatment of eye fatigue through rigorous methodological evidence.

Conclusions

Yoga ocular exercises reduce eye fatigue by increasing the ocular muscle efficiency. Exercises decrease the prevalence and incidence of eye fatigue minimizing asthenopia. Therefore, these findings confirm that yoga ocular exercises can be considered as a nonpharmacologic and therapeutic intervention for reducing asthenopic symptoms as well as relieving the severity of eye fatigue.

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Conflicts of interest

There are no conflicts of interest.

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