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RESEARCH ARTICLE

Use of Iris Mini Software in Reducing Asthenopia and Sleep Cycle

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ABSTRACT

Background: Excessive use of digital screens is leading a number of eye disorders and other adverse effects like sleeplessness, insomnia, ocular discomfort. It is important to evaluate different methods to combat the severity of such eye disorders. The use of Iris Mini Software could be an effective solution to reduce the extent of eye defects.
Objective: The objective of this study was to evaluate the effect of Iris Mini Software on asthenopic symptoms and Sleep cycle in screen users.
Methodology: A longitudinal study was conducted from September 2021 to May 2022 at The University of Faisalabad, involving 30 emmetropic individuals aged between 18 to 30 years and this sample was taken by non-probability convenient sampling technique. All participants had screen time of 5–6 h, with a history of asthenopia and disturbed sleep cycle, excluding those with ocular pathologies, refractive errors, associated problems like migraine, insomnia were excluded. The study assessed asthenopia and sleep cycle before and after introducing them to Iris Mini Software in their devices, followed by a month's follow up with an interval of one week by using self-designed questionnaire.
Results: Iris Mini Software significantly improved asthenopia over the time period of one month significantly ($P < 0.001$) in screen users and also improvement in their sleep duration ($P < 0.0001$). The device was also effective in reducing symptoms of eye strain caused by long exposure of screen and enhancing sleep quality by reducing blue light exposure, which positively influenced melatonin production.
Conclusion: The use of Iris Mini Software illustrates a positive impact on relieving the asthenopic symptoms and improving sleep duration. This research suggests that Iris Mini Software can be an effective solution for the mitigation of poor sleep quality and ocular discomfort.

INTRODUCTION

Human eyes operate much like a sophisticated camera design to focus light onto the retina facilitating day and night vision clear. The retina contains two types of photoreceptors: rods and cons. Rods account for approximately 95% of photoreceptors cells, which are primarily responsible for low light conditions, enabling individuals to perceive at night. In contrast there are three types of cones, each sensitive to different wavelengths of light (red, green and blue); together these are responsible for day vision and enabling color perception and vision under daylight conditions. In 1998, neuroscientist Ignacio Provencio made a groundbreaking discovery by identifying a novel photoreceptor in the human eye known as melanopsin. Unlike the rods and cones melanopsin is involved in conventional vision and is specifically sensitive to blue light and plays a crucial role in regulating the circadian rhythm (Provencio *et al*. 1998). When exposed to blue light, melanopsin sends signals to the brain indicating that it is daylight, suppressing the production of melatonin, a hormone responsible for regulating sleep (Daniel 2014).

Blue light is a high energy light in the visible electromagnetic spectrum, with wavelength ranging from 380–500 nm (Lin *et al*. 2017). It plays a crucial role in the physiology of human beings as it is important for regulation of sleep cycle or circadian rhythm and the response is mediated by melanopsin, a photo pigment found in specialized retinal ganglion cells (Rosenfield *et al*. 2020). During daylight hours, the natural blue light is good for shortening the time of reflex reaction. For boosting the mood, increasing alertness and supporting our overall wellbeing. While on the other hand, the artificial blue light from the screen causes discomfort or ocular fatigue. It also affects pupil and ciliary muscles causing dryness and uneasiness that can overtime lead to headaches and blurred vision (Guarana *et al*. 2021). Prolonged exposure to short wavelength blue light causes the phototoxicity of retinal light sensitivity cells. Overtime this damage can lead to development of disease like Age Related Macular Degeneration (AMD), a leading cause of vision loss (Silvani *et al*. 2022).

Optical radiation encompasses ultraviolet light (100–400 nm), infrared light (750–10000 nm) and visible light (400–750 nm). Mostly, the cornea is naturally equipped to eliminate and act as a barrier from harmful ultraviolet radiations particularly wavelength below 295 nm. However, the wavelength shorter than 400 nm does penetrate to the retina, which may lead to retinal damage more susceptible for retinal pigment epithelium damage and termination toward retinal disorders or evoke photodynamic retinal damage. Over time, prolonged exposure to high intensity light falls on the visible spectrum (400–500 nm). This is mentioned as "blue light hazard" (Ishizawa *et al*. 2021). Overtime repeated exposure to blue light can contribute to development of conditions like AMD.

In the current era, digital screens are most frequently used in workplaces like schools and offices. Around 35.6% of the total population smartphone users have increased globally, and it is increasing because of engaging features and entertainment. Although screen time is high due to engagement and productivity, it also has its adverse effects like sleep deprivation or insomnia and ocular discomfort or dry eye (Heo *et al*. 2017). People under the age of 40 have more ocular symptoms that constitute tiredness, ocular suffer from irritation, dryness, burning eye, redness, blurred vision and diplopia. Actually, the screen emits wavelength of 400–490 nm of blue light that is forefront for Digital Eye Strain (Algvere *et al*. 2006).

Digital eye strain, also known as computer vision syndrome, occurs after prolonged use of digital devices like computers, phones and tablets. It can lead to a range of symptoms including eye discomfort, such as dryness, irritation, or a gritty feeling, as well as blurred vision, particularly after staring at a screen for an extended period (Munsamy *et al*. 2022). People may also experience headaches, often around the forehead or temples, and neck or shoulder pain due to poor posture, sensitivity to light, difficulty to focus and ocular fatigue. Computer vision syndrome affects in two ways. Psychological components stimulate the effect of media at bedtime, which delays sleep. Physiological components concern artificial light exposure that delays the circadian system by suppressing melatonin secretion, that is pivotal for sleep maintenance and institution in humans. The blue light information is met up by photoreceptors, present in retina and then retinal ganglion cells (Wiryawan *et al*. 2021). Further, it is transmitted to suprachiasmatic nucleus (SCN), which in turn transmits to the pineal gland where secretion of melatonin occurs in evening and suppressed in light exposure. The short wavelength light and artificial light suppress melatonin secretion that delay sleep onset (Silvani *et al*. 2022).

Iris mini is software that contains a blue blocking filter but appears red in color which prevents eyes from strain, reduces eye pain and improves sleep. It reduces the brightness of the screen without changing the backlight flickering frequency or current and pulse width modulation (Cheng *et al*. 2014). It gives a large amount of reduction in brightness. The brain is less fast than eyes, so cannot perceive this flicker but in eyes iris start the process of open and close (contract and dilate) like this flicker. However, if the frequency of flickers is lower, iris contraction is greater, the eyes feel tired and painful. So, the best way to overcome this problem is to use software that can change the color and brightness without more blue light (Lee *et al*. 2021). This study evaluated the effect of Iris Mini Software on asthenopic symptoms and Sleep cycle in screen users.

MATERIALS AND METHODS

This longitudinal study was conducted at The University of Faisalabad between September 2021 and May 2022, with a sample of 30 emmetropic participants. The participants were selected using a non-probability convenient sampling method. Eligible participants were individuals aged between 18 and 30 years who reported using screens for 5–6 h on average daily and experienced symptoms of asthenopia, as well as disrupted sleep patterns. Those with ocular conditions, refractive errors, or associated health issues such as migraines or insomnia were excluded from the study.

Prior to participation, informed consent was obtained from each individual. Data collection was carried out using a self-designed proforma and questionnaire. Ocular examinations were performed with a pen torch, and visual acuity was measured using the Log Mar chart. Participants were followed up weekly for a period of three to four weeks. The purpose of the follow-ups was to assess the effects of the Iris Mini software on improving both asthenopia and sleep duration. A comprehensive, self-designed questionnaire was used to monitor changes in participants' symptoms related to asthenopia and their sleep patterns.

To evaluate the data, a Chi-square test was employed to determine that there were significant improvements in asthenopia and sleep duration following the use of the Iris Mini software. The statistical analysis was performed by using SPSS version 20.

RESULTS

In this study 30 emmetropic participants with age range 18-

Table 1: Asthenopia before and after usage of Iris Mini Software

Asthenopia	**Software**	Base line findings	1 week	2 week	3 week	4 week	*P*-value
Watering	After use	18	6	2	0	0	0.000
	Before use	12	24	28	30	30	
Headache	After use	18	9	2	0	0	0.000
	Before use	12	21	28	30	30	
Eye fatigue	After use	22	7	1	0	0	0.000
	Before use	8	23	29	30	30	
Burning sensation	After use	13	7	2	0	0	0.000
	Before use	17	23	28	30	30	
Redness	After use	14	4	2	0	0	0.000
	Before use	16	26	28	30	30	
Itching	After use	19	9	4	1	0	0.000
	Before use	11	21	26	29	30	
Double vision	After use	10	3	0	0	0	0.000
	Before use	20	27	30	30	30	

Table 2: Sleep duration before and after usage of Iris Mini Software

Sleep duration (h)	Base line findings	1 week	2 week	3 week	4 week	*P*-value
3-4 h	6	1	0	0	0	0.000
5-6 h	19	17	7	2	1	
7-8 h	3	10	21	26	25	
> 8 h	2	2	2	2	4	

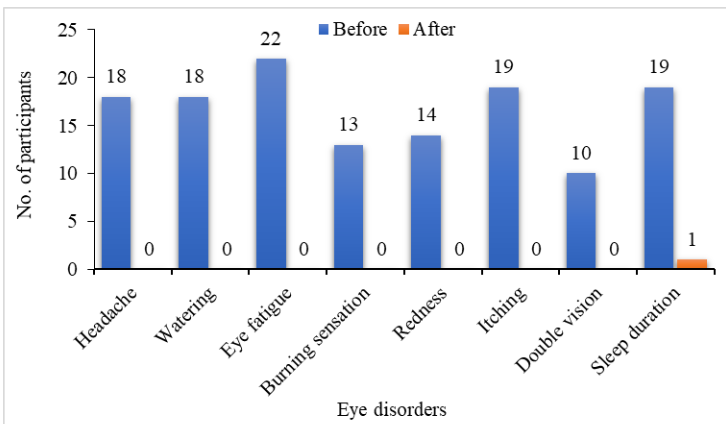

Fig. 1: Frequency distribution of asthenopic symptoms and sleep duration before and after usage of Iris Mini Software

30 years were included. Asthenopia and sleep duration were assessed by using questionnaire proforma from all subjects. Out of 30 participants before usage of Iris Mini software, 18 had complaints of watering and headache, 22 had eye fatigue, 13 had burning sensation, 14 had redness, 19 had itching, 10 had double vision. Six patients had in-sleep duration of 3–4 h, 19 patients have 5–6 h, 3 patients had 7–8 h and 2 patients had more than 8 h. Then after the usage of Iris Mini software for one month, no respondent was left with the problem of asthenopia (Table 1). The in-sleep duration improvements were significant ($P < 0.0001$). Patients of 3–4 h in-sleep duration were 0, 5–6 h were 1, 7–8 h were 25 and more than 8 h were 4 (Table 2). This study gives us an innovative idea if the Iris Mini Software remained in highly inactive mode during usage of screen, with a significant reduction in different eye disorders (Fig. 1).

DISCUSSION

Excessive screen work and blue light exposure cause muscle fatigue, asthenopic symptoms and also disturb sleep cycle because it suppresses melatonin hormone that regulate the sleep cycle. Iris Mini software filters the blue light, which consequently prevents the occurrence of these symptoms. A pilot study by Knufinke *et al*. (2019) evaluated the effect of blue blocking filters on 15 clients of the age range of 18–32 years in Europe and reported improved sleep-in athletes by blocking blue light in the evening. Their study supported this notion as the results were revealed that blue blocking filters were significant in athletes to improve sleep quality. In this study Iris Mini software was introduced to a total of 30 participants that were able to show the positive response to this software.

Another observational study was conducted by Palavets and Rosenfield (2019) to see the effects of blue blocking filters on asthenopic symptoms of 24 emmetropic participants, ageing 22 to 27 years. The subjects were given a task to read a paragraph for 30 min on a computer having a blue light filter with 90% contrast. They concluded that the blue light filter had the minimum effect to vanish the asthenopic symptoms that occurred at near due to screen because their participants were using the blue light filter only for 30 min. In contrast the results of this study proved that the blue filters improved the asthenopia significantly.

CONCLUSIONS

Asthenopia and disturbed sleep was present in 30 screen users. Iris Mini Software was effective in improving symptoms of asthenopia and disturbance of sleep cycle, signifying its use on a wider scale.

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AUTHOR CONTRIBUTIONS

AA: data analysis, final review, overall supervision; AM, TI, SN and MI: concept, study design, data collection, literature search, data analysis.

CONFLICTS OF INTEREST

The authors declare that they possess no conflicts of interest.

DATA AVAILABILITY

The data will be made available on a fair request to the corresponding author.

ETHICS APPROVAL

Approved by Institutional Ethical Review Board at its meeting held on February 23, 2022.

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