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Understanding the Impact of Digital Devices on Eye Health

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Abstract: Background: The use of technological devices has become very high recently, which negatively affects the quality of eye health in the long term. Objective: This study was focused greatly on the assessment of eye health for participants. Patients and methods: A cross-sectional study was conducted over a period lasting from April 17, 2022, to October 24, 2023, for 110 participants for the purpose of identifying and evaluating eye health outcomes for people who use digital devices. This study recorded the main symptoms of people who suffer from eye strain, and degrees of eye strain were distributed among the included samples, which were determined according to criteria that included no eye strain or mild, moderate, or severe eye strain. A comprehensive assessment of eye health was performed by relying on both the Schirmer test to determine the extent of dry eyes and the Snellen test to examine visual acuity. Results: The current study showed that people under the age of 15 are the most vulnerable to or have visual problems. Our results found that males with 60 people were more than females with 50. Our study found that the percentage of people who use digital devices for less than 6 hours was 22 people, and Over 6 hours with 88 individuals, I found the number of digital devices used. The individuals who used one device were 18 patients, the individuals who used two devices were 42 patients, and the individuals who used three devices were 50. Our results identified the common symptoms of patients in terms of eye strain in 16 patients, blurred vision in 12 patients, tears in 9 patients, and dry eyes in 16 patients. For Snellen letters lost, our results found that 0-5 included 77 patients, 5-10 included 11 patients, and >10 included 22 patients. The results of the logistic regression evaluation of the risk factors affecting eye health showed that we found that age, duration, and variety of use of electronic devices, as well as symptoms, may affect eye health negatively. Conclusion: Our study indicated that excessive use and prolonged use of digital devices impair eye health and increase visual symptoms for the participants.

Keywords: Digital eye strain; Eye health; Symptoms; Schirmer test; and Snellen test.

INTRODUCTION

During the last decade, the use of technological devices has increased, generating a great impact on society due to their easy accessibility and handling in all kinds of fields, both work and academic, resulting in a greater visual demand for the users of these devices (Parihar, J. K. S. *et al*., 2016).

Visual pathologies caused by the use of computers are currently one of the most common conditions among workers. In recent decades, society has undergone a great change (Sheppard, A. L., & Wolffsohn, J. S. 2018). The arrival of the technological era, and with it the use of electronic devices, has changed the current landscape both in the workplace, in academia, and at home (Sweetser, P. *et al*., 2012). There is no denying that these advances contribute positively to solving problems in modern life, time economy, work efficiency and task organization. However, it leads to an increase in certain pathologies (Council, Vision, 2016).

Digital technological devices are available in many formats, with screens of different shapes and sizes, ranging from huge desktop screens to small smartphones and now even small digital watches (Palaiologou, I. 2016; CVS, 2020). These have increased the potential stress on the ocular system, and patients report an increasing change in related symptoms, which together are known as digital visual fatigue (DES) (Blehm, C. *et al*., 2005). However, this diversity of devices has a wide range of working distances, observation angles, luminance, and contrast situations, and as a result, a wide range of potential symptoms to address in the consultation (Yan, Z. *et al*., 2008; Rosenfield, M. 2011; Phamonvaechavan, P. 2017).

An American study was indicated that the frequency with which teachers use technological devices is high since they use them for 4 to 6 hours a day, taking into account that their work activities depend on the use of some device and additionally, they also use it in their free time (Maducdoc, M. M. *et al*., 2017). The frequency with which teachers take active breaks was determined low since 59% of teachers do not take active breaks whenever they use technological devices; they report that they take breaks only a few times (sporadically or once a week), and there is no

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frequency in time of the breaks taken per day (Thomson, W. D. 1998; Salibello, C., & Nilsen, E. 1995; Cole, B. L. *et al*., 1996; LIE, I., & WATTEN, R. G. 1994).

Therefore, we conclude that it is of vital importance for teachers to carry out programs of the prevention and promotion of visual health at work, where topics such as the relevance of visual pauses are included and how they should be done (Scheiman, M. 1996).

In France in 2017, over time, it has been observed that although visual fatigue due to technological devices is a frequent topic and of great research at present, there are no recent studies on this topic in teachers; that is, the populations are usually children or university students, which is considered relevant to take into account the teaching population since they possibly also give an important use of time to technological devices that could be affecting their visual health without any control (Bhanderi, D. J. *et al*., 208; Titiyal, J. S. *et al*., 2018; Kim, D. J. *et al*., 2017; Knave, B. G. *et al*., 1985).

PATIENTS AND METHODS

We conducted a cross-sectional study that greatly contributed to identifying and evaluating eye health outcomes for people who use digital devices for a period that lasted from April 17, 2022, to October 24, 2023. One hundred ten participants were collected in this validated study that included data for both male and female genders.

Specific data was included for the participating people, which included ages between < 15 and 30. This data included age, gender, professional status, and job status, which were defined in terms of student, employed, and unemployed, and the number of hours of using digital devices, which were defined as less than 6 hours and more than 6 hours, the number of uses of digital devices, which included one device, two devices, and three devices, and the number of digital activities, which included one activity, two activities, and > 2 activities.

A procedure was conducted to identify the most common general symptoms associated with the people participating in this study, resulting from digital eye strain and affecting eye health, which included itching, foreign body sensation, tears, excessive blinking, eye pain, drooping eyelids, dry eyes, blurred vision, and blurred vision, double vision, difficulty concentrating near the body, seeing colored circles, feeling deteriorating vision, and headache.

Eye strain scores were distributed among the participants, which were defined as levels for no eye strain or mild, moderate, or severe eye strain. Eye health assessments were carried out in terms of both the Schirmer test scale, which was used to measure the severity of dry eyes, and grades, in which values greater than 15 mm of wetness are considered the occurrence of normal tear production, while values between (5 to15 mm indicate the presence of dry eyes among, mild to moderate, but values less than 5 mm indicate a degree of severe dryness in the eye. Moreover, the Snellen test was used, which represents the most widespread and approved test to examine visual acuity by determining letter loss, which included criteria (0–5, 5–10, and > 10). Also, a self-assessment of eye health was conducted for all included samples, which were evaluated based on excellent, good, satisfactory, and poor. A multivariable logistic regression analysis was performed to identify risk variables affecting patients with digital eye strain. All the results of the collected samples were analyzed by SPSS program version 22.0.

RESULTS

Table 1: Basics demographic characteristics of participants in this study.

Variables	Number of patients [110]	P [%]
Age, years		
< 15	40	36.36%
15 – 19	30	27.27%
20 – 25	24	21.82%
26 – 30	16	14.55%
Gender, M/F		
Males	60	54.55%
Females	50	45.45%
Occupation status		
Student	70	63.64%

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Employed	30	27.27%
Unemployed	10	9.09%
Number of hours of use of digital devices per day		
< 6 h	22	20%
> 6 h	88	80%
A number of digital devices use		
One device	18	16.36%
Two devices	42	38.18%
Three devices	50	45.45%
Number of digital activities		
One activity	22	20%
Two activities	77	70%
> 2 activities	11	10%

Table 2: Determine the most common of symptoms associated with participants in this study.

Symptoms	**Number of patients [110]**	**P [%]**
Itching	6	5.45%
Foreign body sensation	4	3.64%
Tears (watering)	9	8.18%
Excessive blinking	6	5.45%
Eye strain	16	14.55%
Drooping eyelids	7	6.36%
Dryness of eyes	16	14.55%
Blurring of vision	12	10.91%
Double vision	5	4.55%
Difficulty focusing near object	2	1.82%
Seeing colored halos	8	7.27%
Feeling of worsening eyesight	9	8.18%
Headache	10	9.09%

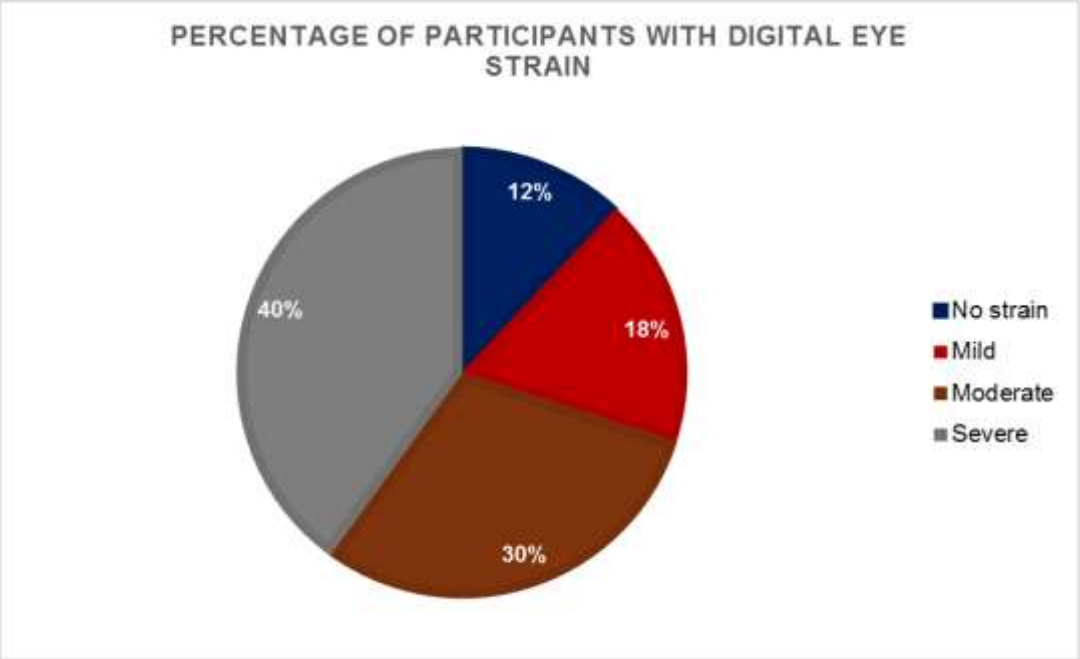

Figure 1: Distribution of eye strain grades among participants in this study.

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Table 3: Assessment of acute Dryness of eyes for participants by Schirmer test.

Variables	Participants [mean (SD)]	Level of vision impairment
< 5 mm	8.0 (3.0)	Severe
5 -15 mm	70.0 (8.0)	Mild to moderate
> 15 mm	16 (5.0)	Normal

Table 4: Assessment of visual acuity outcomes by Snellen scale.

Snellen letters lost	Number of patients [110]	Percentage [%]
0 – 5	77	70.0%
5 – 10	11	10.0%
> 10	22	20.0%

Table 5: Subjective assessment of eye health for samples participating in this study.

Grades	Number of patients [110]	P [%]
Excellent	22	20.0%
Good	14	12.73%
Satisfactory	10	9.09%
Poor	64	58.18%

Table 6: A multivariate logistic regression analysis was performed, determining the risk variables that impact patients with digital eye strain.

Risk factors	**OR [95% CI]**	**P-value**
Age < 15 years	2.14 [1.02 – 4.82]	0.0411
Gender		
Males	4.34 [2.02 – 9.65]	< 0.0001
Females	4.051 [1.98 – 8.76]	< 0.0001
Symptoms		
Eye pain	3.3 [1.52 – 7.1]	0.0031
Dryness of eyes	4.84 [2.01 – 6.11]	0.00258
Headache	3.80 [1.21 – 5.33]	0.0036
Seeing colored halos	5.50 [2.42 – 10.72]	0.00261
Blurring of vision	4.72 [2.75 – 9.64]	0.00034
Digital devices use > 6 hours per day	3.50 [1.6 – 7.86]	0.00068
Use > 2 digital activities	7.62 [3.01 -20.77]	0.0001

DISCUSSION

This current study recorded all demographic data for people who suffer from eye health problems while using digital devices, which included people under the age of 15 who are most at risk or have visual problems. Our results found that males with 60 people were more than females with 50. The employment status was found to include 70 students, 30 people who were employed, and ten people who were not employed. Our study found that the percentage of people who use digital devices for less than 6 hours was 22 people, and for more than 6 hours, it was 88 people. We found the number of digital devices used was Individuals who used one device were 18 patients, individuals who used two devices were 42 patients, and individuals who used three devices were 50. The number of digital activities was one activity with 22 patients, two activities with 77 patients, and > two activities with 11 patients.

We identified the most common symptoms associated with participants in this study, and we found the most common and influential symptoms on eye health, which included eye strain (16 patients), blurred vision (12 patients), tearfulness (9 patients), and dry eyes (16 patients). Furthermore, this study showed eye strain scores among participants. Our results found the eye strain rate included 12% of patients with no eye strain, 18% of patients with mild eye strain, 30% of patients with moderate eye strain, and 40% of patients with mild eye strain. They have extreme stress.

For the eye health assessment, our results assessed for participants' severe dry eye using the Schirmer test included < 5 mm was 8.0 (3.0), 5 -15 mm was 70.0 (8.0), and> 15 mm was 16 (5.0). For Snellen letters lost, our results found that 0-5 included 77 patients, 5-10 included 11 patients, and >10 included 22 patients. In addition, the results of the

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logistic regression evaluation of risk factors affecting eye health showed that we found that age, duration, and variety of use of electronic devices, as well as symptoms, may affect the safety and health of the eye, causing poor vision and increasing the severity of symptoms.

Previous studies have shown that prolonged and excessive use of digital devices has a significant and negative impact on people's visual vision, which increases the severity and severity of symptoms for patients (Ichhpujani, P. *et al*., 2019). Another study in America showed that symptoms after continuous use of the computer are bad, especially blurred vision, watery eyes, and dry eyes as a result of spending long hours on digital devices.

CONCLUSION

This study found that digital devices have a negative impact on daily eye health as a result of daily misuse. Our study indicated that the length of time and variety of use of digital devices, as well as social interactions, cause an increase in symptoms and their severity. Our results recorded the most common symptoms, most of which were eye strain, blurred vision, tears, and dry eyes, which weaken the quality of eye health. Our study showed the risk factors affecting the quality of eye health and confirmed that age, excessive use, duration, and symptoms are the most dangerous factors for vision in the long term.

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