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Original Article

Association Between Screen Time and Tear Film Stability

Mawra Zahid[1*], Maimoona Rehmat[1] and Hifza Imtiaz[1]

[1]Department of Optometry and Vision Sciences, The University of Lahore, Lahore, Pakistan

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***Corresponding Author:**

Mawra Zahid

Department of Optometry and Vision Sciences, The University of Lahore, Lahore, Pakistan

mavrazahid12@gmail.com

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ABSTRACT

Tear film is a layer that nourishes, lubricates and protects the anterior surface of eye. The usage of electronic gadgets can affect the tear film stability causing ocular dryness. Recently, due to the increased frequency of online educational and leisure activities, there has been reported increase in the prevalence of dry eye among users of electronic gadgets. **Objective:** To evaluate association between screen time and stability of tear film. **Methods:** A descriptive cross-sectional study was conducted from January to august 2021 at The University of Lahore. 120 participants aged above 18 years were recruited using nonprobability sampling technique. After taking consent from the participant's questionnaire was completed, followed by slit lamp examination for evaluation tear film breakup time (TBUT). **Results:** 120 healthy people of either gender who were at least 18 years old participated in this study, selected through random sampling, informed consent was acquired from all participants. The TBUT test was performed on all subjects, 74 had severe dry eyes, 21 had moderate dry eyes, and just 24 had normal eyes. Each subject's screen time was tracked after the subjects were divided into four groups. The Chi square was used to assess the relationship between screen time and tear film break up time. Results had a p value less than 0.01 and were statistically significant. **Conclusions:** This study concluded that as the screen time increases it effects the stability of tear film.

INTRODUCTION

An important component of ocular surface is tear film (TF) as it maintains ocular surface health. This (TF) is made of three layers and there is no barrier between these layers. It is not secreted as complete solution; different glands secrete different layers of tear film [1]. It is composed of Mucin, Enzymes, glycoproteins, immunoglobulins, lipids, electrolytes and water [2]. TF is a crucial component of ocular protection., there are number of factors such as extreme temperature, antimicrobial components in tear film helps to protect the ocular surface from infection and can be severely affected by irritants and allergens [3]. It has three layers, including an outer lipid layer, an aqueous middle layer and innermost mucus layer over the 1st layer of cornea [4]. The lipid layer which is the most outer layer provide a smooth surface and retard the rate of tear evaporation from the cornea [5]. The aqueous layer, which is made of water and helps the tear film spread, gives the cornea oxygen and nutrients [6]. The accessory lacrimal glands, such as the wolfring and Krause glands, are responsible for the basal secretion of the second layer of tear film [7] whereas the primary lacrimal gland is responsible for reflex tear film secretion. This layer is mildly alkaline and has an osmolarity of 300 mOsm/l [8]. The tear film's innermost layer acts as an anchor and promotes tear film adhesion to the eye [9]. It is important for protection of anterior corneal surface, act as a polish for cornea. One of the most significant characteristics of tear film is its stability, which is required for ocular surface protection. All

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of the tear film's components and layers, such as the lipid layer, aqueous layer, and mucin layer, must be present to keep the tear film stable [10]. Tear film not only protects from dryness, infection it also maintains the transparency of cornea and is essential for the optimal functioning of the eyes. It nourishes, lubricates and protects anterior surface of eyes. Tears are continuously absorbed and evaporated from the ocular surface [11]. When digital devices are excessively used then blink rate decreases significantly because of which Meibomian glands are not sufficiently stimulated to release the tear film's lipid layer [12]. The use of computers, laptops, tablets, and smartphones has steadily increased over the past few years with the passage of time and the development of technology [13]. The intermediate holding distance required by these digital devices puts pressure on the visual system, which is designed for comfortable near and distant vision [14]. The use of these electronic devices has significantly increased during the previous few years [15]. According to optometric association two hours of continuous screen time per day is enough for causing eye related problems like decrease blink rate and dryness [16]. Digital eye strain is a manifestation of evaporative dry eye it is increased in COVID pandemic [17] as the whole learning system has been shifted to the online classes and are using their tablets, mobiles and laptop more often for educational as well as sports/leisure time [18].

METHODS

From January 2021 to August 2021, 120 (n=z2pq/e2) subjects selected through convenient sampling were included in this descriptive cross-sectional study conducted at The University of Lahore. All the subjects with age limit 18-30 were included. patients with mental retardation, systemic, congenital, or ocular disorders were excluded, as well patients who had undergone any eye surgery or who had worn contact lenses. Each subject's proper informed consent was obtained. Depending on their age, patients were placed into three groups. Group 1 includes respondents between the ages of 18 and 21; Group 2 includes subjects between the ages of 22 and 25; and Group 3 includes subjects between the ages of 26 and 30. Data were collected from the subjects with the help of self-designed Performa The Performa was created to gather data regarding screen time. After taking proper history, Performa was administered to evaluate subjects screen time then tear film stability was examined by tear film break up time in which fluorescein dye was instilled in eyes then subject is instructed to not blink adjust patient on slit lamp and start examining on cobalt blue illumination The length of time between the final blink and the appearance of the first dry area in the tear film is known as the tear break up time. Three categories are used to classify tear film breakup times. Less than five seconds are regarded as low, between five and ten seconds as marginal, and more than ten seconds as normal. SPSS version 21.0 was used to analyze the data.

RESULTS

This study consisted of both eyes of 120 normal subjects of either gender aged above 18years from all subjects informed consent was obtained. The overall number of subjects in Group 1 (18 to 21 years), Group 2 (22 to 25 years), and Group 3 (26 to 30 years) was 37 (30.8%), 50 (41.7%), and 33 (27.5%), respectively. A total of 57 females and 63 guys made up the sample. Males were more common than females (52.5% vs. 47.5%), by a wide margin. TBUT test was performed on all 120 subjects out of which 79(65.8%) had severe dry eye while 26(21.7%) had moderate dry eye and only 15(12.5%) subjects were normal. Screen use of total 120 subjects were divided in to four categories, screen time was measured in 120 subjects out of which 79(63.3%) had screen time more than 8 , 24(21.7%) subjects had screen time more than 6 hours, 12 subjects had screen time of 3-5(10.0%) hours while on only 8(6.7%) subjects had screen time less than 1-2 hours. Chi square was used to assess the relationship between screen time and tear film break up time. Chi square shows significant p value < 0.01 relationship between screen time and tear film stability.it means as the screen time increases it effects the stability of tear film. Total 120 subjects were included in this study of either gender male or female age ranging from 18 above years of age. All individuals were divided in to three age groups. Total 37 subjects were lies in 18-251years of age. 50 individuals are in group 22-25 and only 33subjects were presented with ages 26-30 year of age. As shown in table 1.

Table1: Frequency of age of different individuals

Age	Frequency (%)
18-21 years	37(30.8)
22-25years	50(41.7)
26-30 years	33(27.5)
Total	120(100)

Figure 1 shows total 120 subject are involved in this study. out of 120 subjects total 63 males (52.5%) frequency and females are 57 (47.50%) were undergone TBUT measurements.

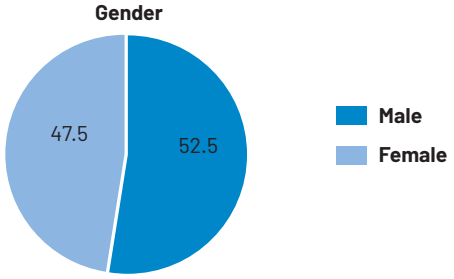

Figure 1: Frequency of gender included in study

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Table 2 shows chi square analysis of total 120 subjects were included on which TBUT was performed on screen users, divided into 3 categories. (74) subjects having screen time of more than 8 hours have sever tear film instability (< 5 seconds), 21 subjects having screen time more than 6 hours have moderate tear film instability (5-10 seconds), 24 subjects having screen time more than 6 hours are normal (>10 seconds). Study shows significant results($p<0.01$).

Table 2: Chi square test was applied to assess the relationship between screen time and tear film Stability.

TBUT	1-2 hours (less)	3-5 hours (moderate)	>6 hours (high)	>8 hours (high risk)	Total	p-value
< 5 seconds (Low)	0	1	3	74	79	0.01
5-10 seconds (Marginal)	2	3	21	0	26	
>10seconds (normal)	6	8	0	1	15	
Total	8	12	24	75	120	

DISCUSSION

In this clinical research we assessed the relationship between screen time and tear film stability, screen time was assessed by self-designed Performa while tear film stability was assessed by tear film break up time. Screen time was divided into 4 categories while tear film stability was divided into three categories. Our study shows significant relationship ($p=<0.01$). In 2021, Verma *et al.*, did a cross-sectional study at a teaching institute to determine the prevalence of computer vision syndrome and dry eye in computer operators. One hundred participants were included in the study based on the inclusion criteria [19]. A questionnaire was created to enquire about CVS symptoms. The Ocular Surface Disease Index (OSDI), refraction, Schirmer's test 1, and tear film break-up time (TBUT) were all carried out. The data were gathered and analyzed using SPSS software. 74% of people were found to have CVS. 39 women and 61 men made up the study's sample size. Depending on the working hours, the majority of the participants (37.84%) worked 4–8 hours every day. 37.84% of participants who worked between 4 and 8 hours did so. According to the OSDI score, 41 individuals had moderate dry eye and 23 individuals had mild dry eye. 58% of the left eye and 59% of the right eye both had dry eyes. The study's conclusion is that the prevalence of dry eye has increased as a result of the increased use of computers in daily lives. Similarly, in our study120 subjects those who were screen users, divided into 3 categories. (74) subjects having screen time of more than 8 hours have sever tear film instability (<5 seconds), 21 subjects having screen time more than 6 hours have moderate tear film instability (5-10 seconds), our study co relate with results of our study that screen time has significant effect on tear film stability [19]. Peak Kyung's study, which he conducted among college students to evaluate the association between addictive smart phone use, dry eye syndrome, upper extremity discomfort, and depression, produced results that were in agreement with those of our study. A self-report questionnaire was utilized to gather data from 286 college students for this study. 15.0 % of people reported having a smartphone addiction. Our study likewise came to the same conclusion that increasing screen time has a serious negative impact on eyes, inducing dryness, comparable to his study's conclusion that addicted smart phone use has large disparities in dry eye [20]. Our findings were consistent with a study conducted by Loebis *et al.*, on the relationship between exposure time to mobile devices and the prevalence of evaporative dry eyes as one of the symptoms of computer vision syndrome among Senior High School Students. The data show that 94 students participated in this study. There were 82 students overall who had evaporative dry eyes (87.2%). Thirteen kids (11.7%), 18 students (19.1%), and 53 students (56.4%) had dry eyes as a result of low exposure, moderate exposure, or high exposure, respectively. A chi square analysis revealed that all HEV exposures have a comparable likelihood of resulting in dry eyes in high school students (p 0.05). This study found that even minimal exposure to mobile devices may increase the risk of developing evaporative dry eyes, one of the symptoms of CVS in young persons with normal tear production [21].

CONCLUSIONS

According to my study there is greatest statistical significance between screen time and dry eyes. Stability of tear film greatly decrease with the increased screen time($p<0.01$). Results of study concluded that screen time has significantly increased during COVID time which has greatly affected the stability of tear film and daily number of students are reporting to clinical set ups with the problem of dry eye.

Authors Contribution

Conceptualization: MZ
Methodology: MR
Formal Analysis: HI
Writing-review and editing: MZ, MR, HI

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Yokoi N and Georgiev GA. Tear-film-oriented

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diagnosis for dry eye. Japanese Journal of Ophthalmology. 2019 Mar; 63: 127-36. doi: 10.1007/s10384-018-00645-4.

[2] Kopacz D, Niezgoda Ł, Fudalej E, Nowak A, Maciejewicz P. Tear Film-Physiology and Disturbances in Various Diseases and Disorders. Ocular Surface Diseases: Some Current Date on Tear Film Problem and Keratoconic Diagnosis. 2020 Oct: 137-44. doi: 10.5772/intechopen.94142.

[3] Stern ME, Beuerman RW, Pflugfelder SC. The normal tear film and ocular surface. Dry Eye and Ocular Surface Disorders. 2004 Jun; 2: 41-62. doi: 10.1201/b14144-4.

[4] Masoudi S. Biochemistry of human tear film: A review. Experimental Eye Research. 2022 May: 109101. doi: 10.1016/j.exer.2022.109101.

[5] Guillon M, Theodoratos P, Patel K, Gupta R, Patel T. Pre-contact lens and pre-corneal tear film kinetics. Contact Lens and Anterior Eye. 2019 Jun; 42(3): 246-52. doi: 10.1016/j.clae.2019.02.001.

[6] Sridhar MS. Anatomy of cornea and ocular surface. Indian Journal of Ophthalmology. 2018 Feb; 66(2): 190-4. doi: 10.4103/ijo.IJO_646_17.

[7] Conrady CD, Joos ZP, Patel BC. The lacrimal gland and its role in dry eye. Journal of Ophthalmology. 2016 Jan; 2016: 1-11. doi: 10.1155/2016/7542929.

[8] Willcox MD, Argüeso P, Georgiev GA, Holopainen JM, Laurie GW, Millar TJ, *et al*. TFOS DEWS II tear film report. The Ocular Surface. 2017 Jul; 15(3): 366-403. doi: 10.1016/j.jtos.2017.03.006.

[9] Zafar A, Ahmad J, Addo RT, Akhter S. Progress of controlled drug delivery systems in topical ophthalmology: focus on nano and micro drug carriers. InOcular Drug Delivery: Advances, Challenges and Applications. Springer, cham. 2016: 131-63. doi: 10.1007/978-3-319-47691-9_9.

[10] Rolando M and Merayo-Lloves J. Management strategies for evaporative dry eye disease and future perspective. Current Eye Research. 2022 Jun; 47(6): 813-23. doi: 10.1080/02713683.2022.2039205.

[11] Swamynathan SK and Wells A. Conjunctival goblet cells: Ocular surface functions, disorders that affect them, and the potential for their regeneration. The Ocular Surface. 2020 Jan; 18(1): 19-26. doi: 10.1016/j.jtos.2019.11.005.

[12] Bahkir FA and Grandee SS. Impact of the COVID-19 lockdown on digital device-related ocular health. Indian Journal of Ophthalmology. 2020 Nov; 68(11): 2378. doi: 10.4103/ijo.IJO_2306_20.

[13] Corcoran P. The Internet of Things: Why now, and what's next? IEEE consumer electronics magazine. 2015 Dec; 5(1): 63-8. doi: 10.1109/MCE.2015.2484659.

[14] Kashyap A, Sumbria M, Sharma S, Kashyap R. To ascertain the effect of digital eye strain on ocular healthamong school children during COVID Pandemic: A cross sectional study. European Journal of Molecular & Clinical Medicine. 2020; 9(03): 2022.

[15] Ganne P, Najeeb S, Chaitanya G, Sharma A, Krishnappa NC. Digital eye strain epidemic amid COVID-19 pandemic–a cross-sectional survey. Ophthalmic epidemiology. 2021 Jul; 28(4): 285-92. doi: 10.1080/09286586.2020.1862243.

[16] Alabdulkader B. Effect of digital device use during COVID-19 on digital eye strain. Clinical and Experimental Optometry. 2021 Aug; 104(6): 698-704. doi: 10.1080/08164622.2021.1878843.

[17] Kaur K, Gurnani B, Nayak S, Deori N, Kaur S, Jethani J, *et al*. Digital Eye Strain-A Comprehensive Review. Ophthalmology and Therapy. 2022 Jul: 1-26. doi: 10.1007/s40123-022-00540-9.

[18] Žigić V, Savković Z, Maćešić-Petrović D, Veselinović M. The contribution of information technology in the education of high school students with visual impairment. InProceedings TIE 2018. 7th International Scientific Conference Technics and Informatics in Education, Čačak, Serbia 2018.

[19] Verma S, Midya U, Gupta S, Shukla Y. A cross-sectional study of the prevalence of computer vision syndrome and dry eye in computer operators. TNOA Journal of Ophthalmic Science and Research. 2021 Apr; 59(2): 160. doi: 10.4103/tjosr.tjosr_173_20.

[20] Paek KS. A convergence study the association between addictive smart phone use, dry eye syndrome, upper extremity pain and depression among college students. Journal of the Korea Convergence Society. 2017 Feb; 8(1): 61-9. doi: 10.15207/JKCS.2017.8.1.061.

[21] Loebis R, Subakti Zulkarnain B, Zahra N. Correlation between the exposure time to mobile devices and the prevalence of evaporative dry eyes as one of the symptoms of computer vision syndrome among senior high school students in east Java, Indonesia. Journal of Basic and Clinical Physiology and Pharmacology. 2021 Jun; 32(4): 541-5. doi: 10.1515/jbcpp-2020-0478.