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ORIGINAL RESEARCH

A study on Digital Eye Strain (DES) among patients attending at tertiary care hospital

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ABSTRACT

Purpose: Digital eye strain comprises of visual and ocular symptoms which arises due to the prolonged use of digital electronic devices. The usual ocular symptoms presented by them are dry eyes, headache, foreign body sensation, itching, blurring of vision and watering. The study aimed to assess the prevalence of digital eye strain, the various risk factors of digital device usage pattern and to co-relate them statistically with clinical features. **Place of study:** Regional Institute of Ophthalmology, Guwahati Medical College & Hospital. **Type of study:** Hospital based Prospective cross-sectional study. **Duration of study:** 12 months. **Materials and Methodology:**500 participants were screened for Digital Eye Syndrome. All the patients were subjected to detailed history taking including pattern of device usage, visual acuity and slit lamp examination. **Results:** The age groups involved in the study were 11-30 (43.4%), 31-40 (34%) and above 40 (22.6%) years. Most symptoms show a significant increase in the >40 years age group, indicating that these symptoms are more prevalent among older individuals.In this study, 60 % were females and 40% were males indicating that age likely influences these symptoms. All the symptoms were statistically significant associated with average time spent for digital device usage, taking preferred break after 30 minutes of continuous usage of digital device, approximate distance of digital device from eyes except foreign body sensation and double vision. **Conclusion:** Dry eye, watering, headache, blurring of vision, and double vision show statistically significant differences in the prevalence between males and females. All the symptoms were statistically significant indicating digital eye strain. With increase in use of digital device, it has led to these asthenopic symptoms, hence public awareness should be implemented.

Keywords: Digital eye strain, Computer vision syndrome.

INTRODUCTION

Digital eye strain (DES) or Computer vision syndrome (CVS) used alternatively, comprises of visual and ocular symptoms which arises due to the prolonged use of digital electronic devices such as desktops, tablets, e-readers, cell phones. Globally, newer advancements and innovations in technology has changed the world into new and various dimensions. Since the invention of computer, information's are passed digitally from communication to living assets to healthcare to education systems. Like Industrial Revolution, technology has revolutionized digitally, and since 1980 there is no deceleration. Though it has put the entire globe in one screen, this digital revolution has its advantages and disadvantages. Many individuals experience ocular discomfort and vision problems on prolonged digital screen usage. The visual system demands additional eye movements and focus i.e.accommodation for the constant vision of digital device which might be the cause of headache. The blinking action which is required for the spread of tear film is temporarily lost during extended use of these devices and leads to dryness foreign body sensation. Often the letters on the computer or hand held devices are not as precise or sharply defined, the level of contrast of the letters to the background is reduced, and the presence of glare, and reflections on the screen may make viewing difficult[1]. As outlined by the American Optometric association, digital eye strain encompasses a cluster of ocular and vision-related problems attributed to prolonged usage of desktops, laptops, mobile phones, tablets, e-readers and storage devices[2]. Higher risks are those individuals who uses continuously 2 hours or more of digital screen. They develop asthenopic symptoms that can hamper the day to day life of these individuals.

Now a days, every common man has atleast one digital screen device. Moreover,all the professions require digital applicances.

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METHODS

This Hospital based prospective study was conducted in Assam, India during October 2022- September 2023 where 500 study participants were screened for DES related symptoms and history of digital device usage. The study was designed following the tenets of the Declaration of Helsinki, and the protocol was submitted and approved by Ethics Committee. Written consent was taken from all participants. All patients attending OPD between age group 11 to 70 years with vision 6/6(with or without aid) were included in the study.

Exclusion criteria

- Patients having high myopia (> 6.0Dioptres)
- Ocular surface inflammation/infection.
- Cataract.
- Glaucoma.
- Any eye surgery.
- Any retinal pathology.

RESULTS

A total of 500 patients were screened for the digital eye strain.

Table 1: Risk factors for DES.

	No of pts	%
Age group		
11-30yrs	217	43.4
31-40yrs	170	34
>40yrs	113	22.6
Gender		
Females	300	60
Males	200	40
Education		
lliterate	13	2.6
Primary education	25	5
High School	57	11.4
Higher Secondary	93	18.6
Graduation or above	312	62.4
Optical Aid Usage		
Spectacles	192	38.5
Contact lens	33	6.5
Both spectacles and contact lenses	15	3
Non spectacles	260	52

- 43.5% belonged to the age group 11-30 years followed by 34 % between 31-40 years. 60% of the patients were female and 40% were males. 62.4 % patients had education level of graduation or above and 52% patients had no optical aid, 38.5 % had used spectacles.

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Table2: Socio-demographic data and ophthalmic characteristics of study participants.		
	No of pts	%
Avg time /day		
< 4hrs	150	30
4-6 hrs	275	55
>6 hrs	75	15
Screen Distance		
<50cm	350	70
>50cm	150	30
Contrast		
Dark	208	75
Light	292	25
Ideal way (30 min break)		
Yes	208	41.6
No	292	58.4

- On assessing, the average time spent for digital device usage per day, approximate screen distance and light and dark contrast, ideal way of digital device usage were found to be the various risk factors for occurrence of DES.

Table 3: Distribution of various symptoms of DES in study participants.
Table 3.a

Symptoms with gender wise distribution				
Symptoms	Frequency %	Male N=200	Female N=300	p-value
Red eyes	100(20%)	68	32	>0.05
Dry eyes	250(50%)	162	88	<0.05
Foreign body sensation	150 (30%)	95	55	>0.05
Watering	300(60%)	130	170	<0.001
Headache	350(70%)	235	115	<0.001
Temporal difficulty in gaze	150(30%)	80	70	>0.05
Blurring of vision	200(40%)	102	98	<0.05
Eye rubbing	100(20%)	57	43	>0.05
Double vision	50(10%)	40	10	<0.05

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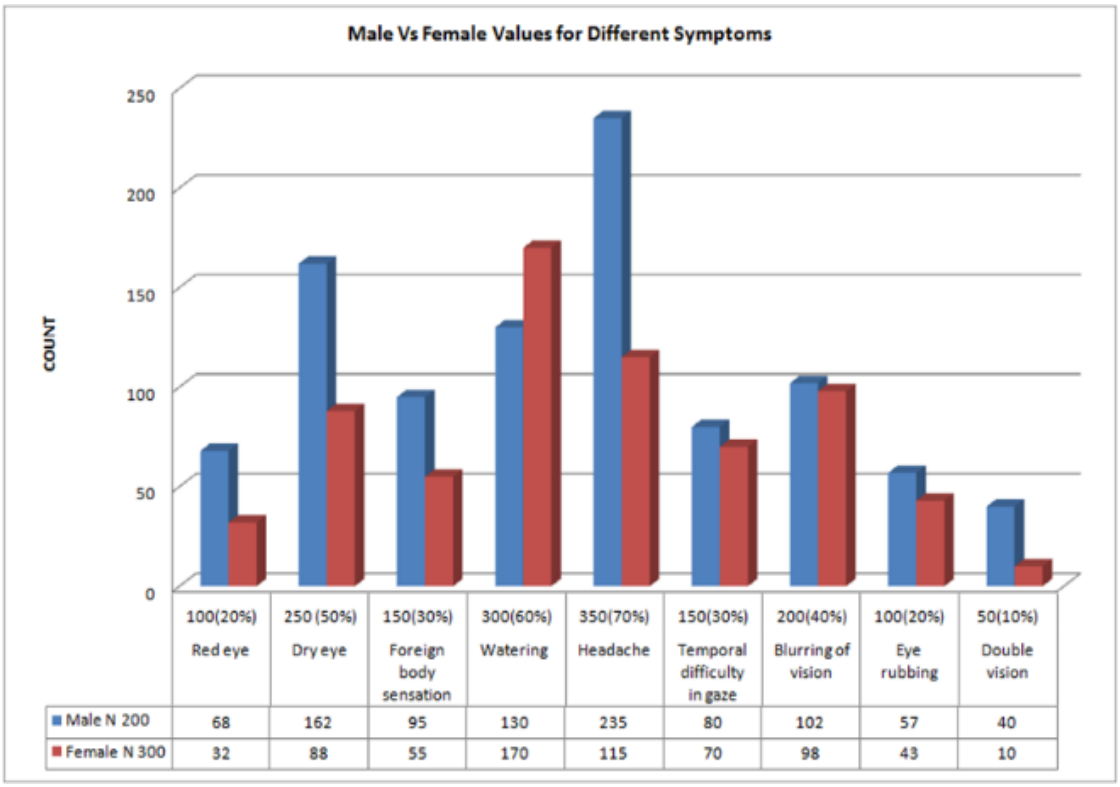

The bar diagram shows red eye, dry eye, foreign body sensation, headache, temporal difficulty in gaze, blurring of vision, eye rubbing and double vision were more in males than females except watering which was more in females.

Table 3.b

Symptoms with age wise distribution					
Symptoms	Frequency %	11-30 yrs N=113	31-40yrs N=170	>40 yrs N=217	p-value
Red eyes	100(20%)	23	25	52	>0.05
Dry eyes	250(50%)	60	57	133	<0.001
Foreign body sensation	150 (30%)	25	20	105	<0.001
Watering	300(60%)	33	107	160	<0.001
Headache	350(70%)	47	138	165	<0.001
Temporal difficulty in gaze	150(30%)	20	52	78	<0.05
Blurring of vision	200(40%)	30	70	100	<0.05
Eye rubbing	100(20%)	10	27	63	<0.001
Double vision	50(10%)	10	15	25	>0.05

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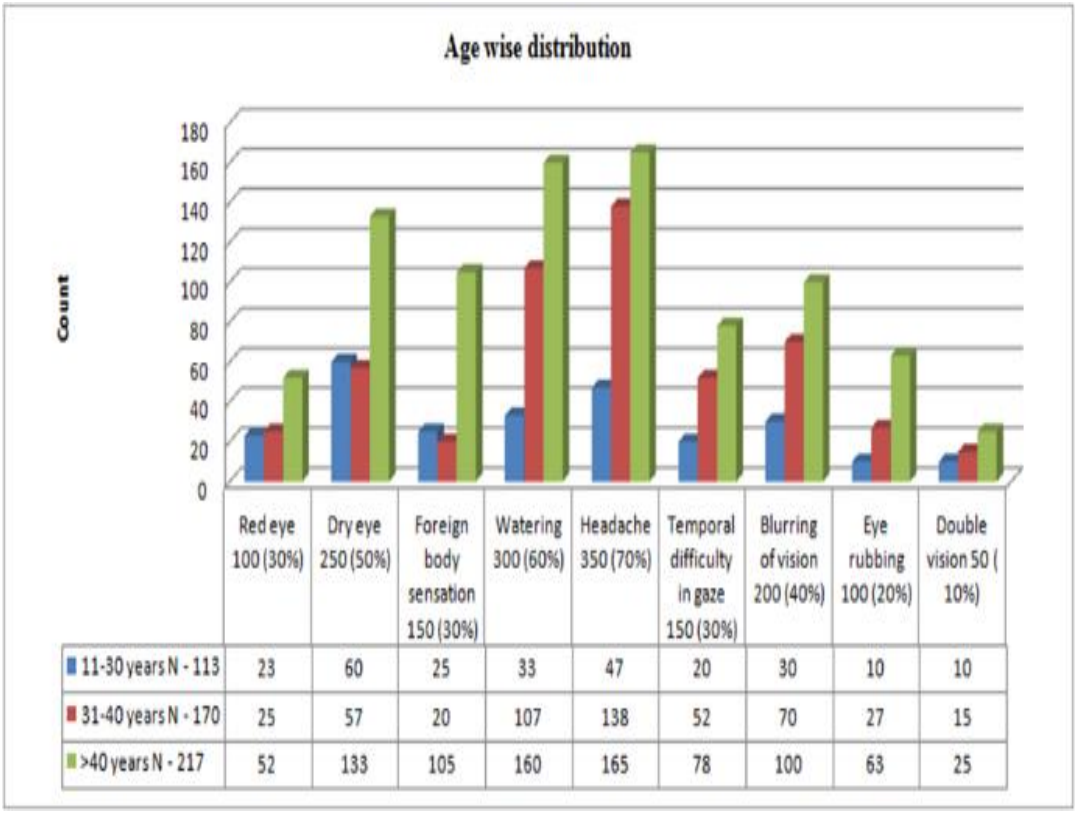

	Red eye 100 (30%)	Dry eye 250 (50%)	Foreign body sensation 150 (30%)	Watering 300 (60%)	Headache 350 (70%)	Temporal difficulty in gaze 150 (30%)	Blurring of vision 200 (40%)	Eye rubbing 100 (20%)	Double vision 50 (10%)
11-30 years N - 113	23	60	25	33	47	20	30	10	10
31-40 years N - 170	25	57	20	107	138	52	70	27	15
>40 years N - 217	52	133	105	160	165	78	100	63	25

This data suggests that many of the symptoms become more common with increasing age, particularly dry eye, watering, and headache.

Chi-square was used to test for p-values. **Significance Threshold**: Typically, a p-value less than 0.05 is considered statistically significant. This means there is less than a 5% probability that the observed differences are due to chance. **Dry eye (p-value = 0.0406, i.e.< 0.05)**, p-value indicated a statistically significant difference between the number of males and females experiencing dry eyes. **Watering (p-value = <0.001)** This extremely low p-value indicates a very strong statistical significance, suggesting a highly significant difference between the number of males and females experiencing watering. **Headache (p-value = 0.000398, i.e.<0.001)**,this p-value is also very low, indicating a significant difference in the gender distribution for headaches. It suggests that the observed differenceis statistically significant and not due to random variation. **Blurring of vision (p-value = 0.0219, i.e.<0.05)**, this p-value is below the 0.05 threshold, indicating a statistically significant difference between males and females experiencing blurring of vision. **Double vision (p-value = 0.00311, i.e.<0.05)**, this low p-value indicates a statistically significant difference between the number of males and females experiencing double vision. So, **dry eye, watering, headache, blurring of vision, and double vision** show statistically significant differences in the prevalence between males andfemales.

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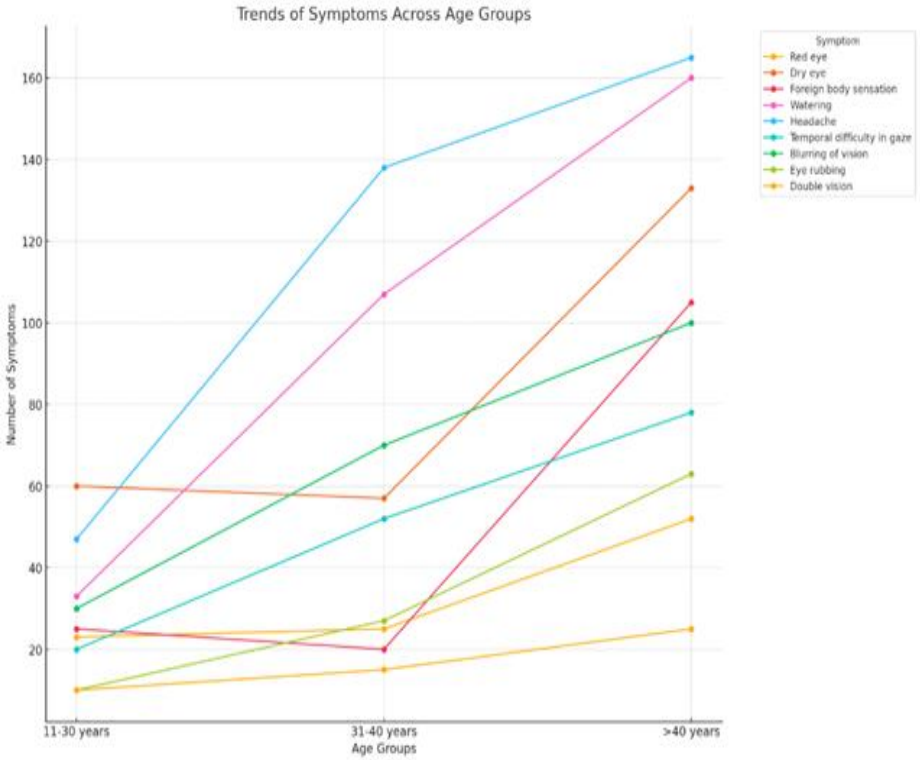

The line plot above shows the trends of symptoms across different age groups. Most symptoms show a significant increase in the >40 years age group, indicating that these symptoms are more prevalent among older individuals. There wasa sharp rise of the line in the >40 years group. Symptoms like watering, headache, foreign body sensation, and dry eye exhibit sharp increases, highlighting a potential age-related trend.

Symptoms with p-values less than 0.05 (dry eye, foreign body sensation, watering, headache, temporal difficulty in gaze, blurring of vision, eye rubbing) show significant differences in their occurrence across age groups, indicating that age likely influences these symptoms.The symptom double vision has a p-value greater than 0.05, suggesting that its occurrence does not significantly differ across age groups and could be due to random variation.

Table 4.a

Symptoms with avg. time spent for digital device usage per day					
Symptoms		<4 hrs	4-6 hrs	> 6 hrs	
		N=150	N=275	N= 75	p-value
Red eyes	100(20%)	35	50	15	< 0.05
Dry eyes	250(50%)	88	117	45	< 0.05
Foreign body sensation	150(30%)	33	92	25	< 0.05
Watering	300(60%)	60	185	55	< 0.05
Headache	350(70%)	75	217	58	< 0.05
Temporal difficulty in gaze	150(30%)	20	100	30	< 0.05
Blurring of vision	200(40%)	70	87	43	< 0.05
Eye rubbing	100(20%)	27	53	20	< 0.05
Double vision	50(10%)	10	15	25	< 0.05

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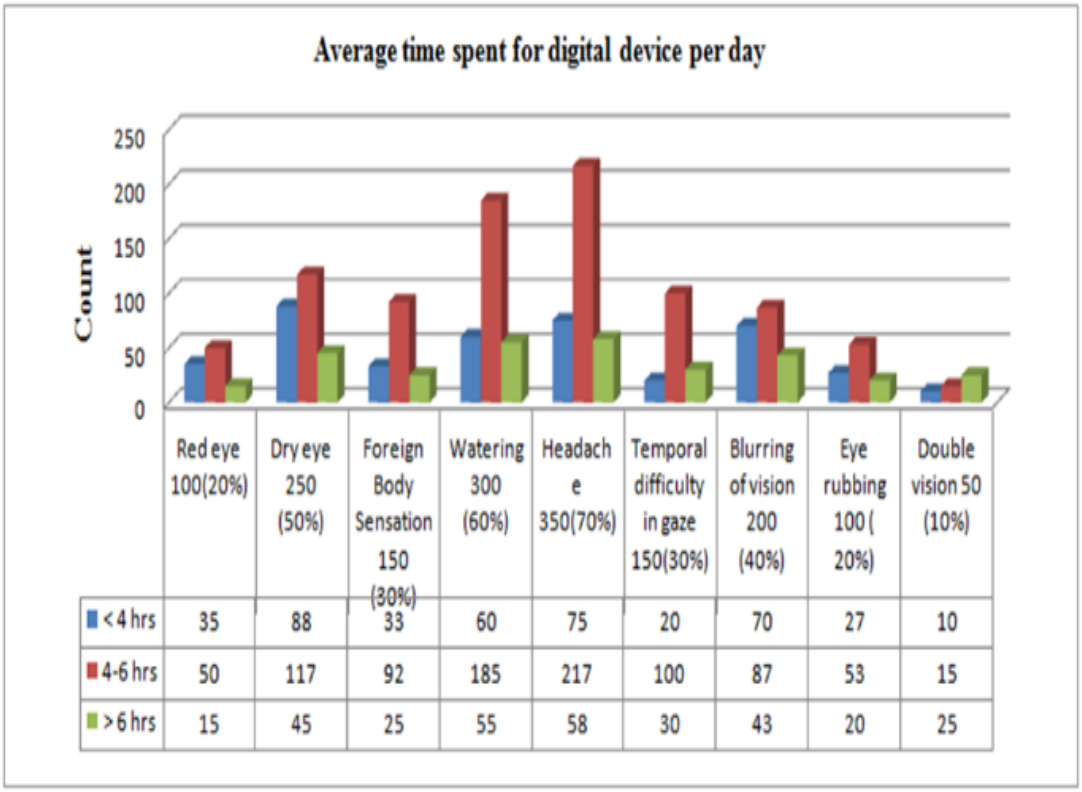

The bar chart involves understanding of the distribution of average time spent on digital devices per day across different conditions. The highest number of individuals in this category spend 4-6 hrs on digital devices.

Table 4.b

Symptoms with approx. distance of digital device from eyes				
Symptoms		<50 cm	>50cm	
		N=350	N=150	p value
Red eyes	100(20%)	58	42	<0.05
Dry eyes	250(50%)	165	85	<0.05
Foreign body sensation	150(30%)	83	67	>0.05
Watering	300(60%)	222	78	<0.05
Headache	350(70%)	275	75	<0.05
Temporal difficulty in gaze	150(30%)	87	63	<0.05
Blurring of vision	200(40%)	130	70	<0.05
Eye rubbing	100(20%)	60	40	<0.05
Double vision	50(10%)	30	20	>0.05

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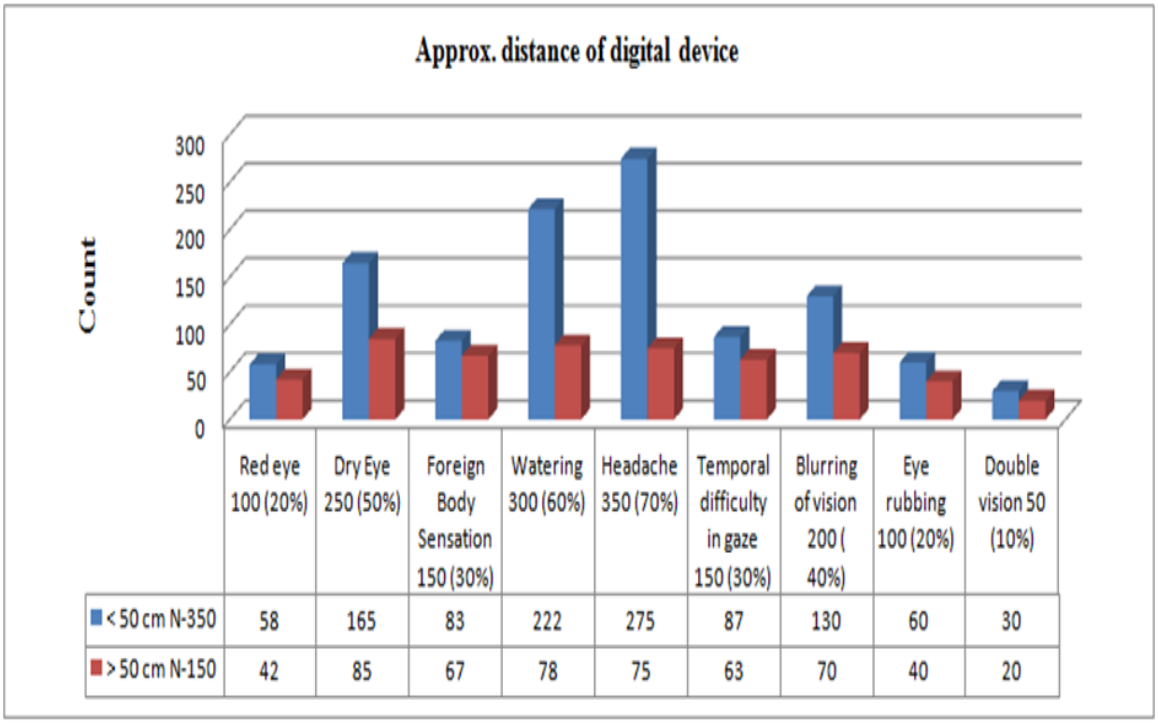

The image is a bar chart showing the approximate distance from a digital device for different symptoms. For most conditions, a significant number of individuals fall into the < 50 cm category, indicating a possible correlation between closer device use and these symptoms.

Table 4.c

Symptoms with taking preferred break after 30 min				
Symptoms		Yes	No	
		N=208	N=292	p value
Red eyes	100(20%)	28	72	<0.05
Dry eyes	250(50%)	92	158	<0.05
Foreign body sensation	150(30%)	30	120	<0.05
Watering	300(60%)	85	215	<0.05
Headache	350(70%)	65	285	<0.05
Temporal difficulty in gaze	150(30%)	25	125	<0.05
Blurring of vision	200(40%)	120	80	<0.05
Eye rubbing	100(20%)	35	65	<0.05
Double vision	50(10%)	10	40	<0.05

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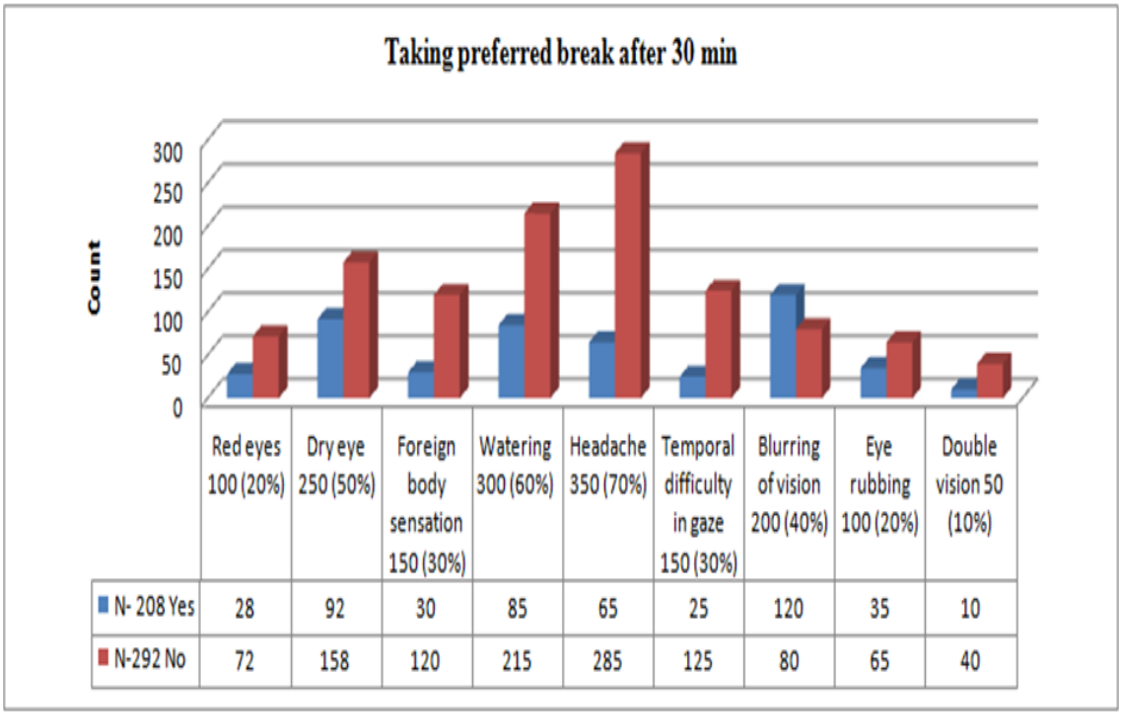

The image is a bar chart showing the distribution of individuals taking a preferred break after 30 minutes of using digital devices, categorized by various conditions. For most conditions, a significant number of individuals fall into the "No break" category, indicating a possible correlation between not taking breaks and the occurrence of these conditions.

Avg. time spent for digital device usage per day: For all symptoms, Fisher's exact test yields very low p-values, indicating that the distribution of cases across the time intervals is statistically significant. This suggests that there is a significant association between the condition and the time intervals, meaning the observed distribution is not due to chance. all the p-values from Fisher's exact test are extremely low (much less than 0.05), indicating statistically significant associations for all conditions. There is a statistically significant association between eachsymptom and the time intervals. This suggests that the amount of time spent (in the specified intervals) is significantly associated with the occurrence of these conditions.

Distance from a digital device: Fisher's exact test p-values for each condition based on the distance from a digital device have been calculated. These indicate a statistically significant association between the distance from a digital device and the condition. The conditions with significant p-values (<0.05) are: red eye, dry eye, watering, headache, temporal difficulty in gaze, blurring of vision and eye rubbing. The conditions with non-significant p-values (> 0.05) are: Foreign Body Sensation and Double vision. These indicate no statistically significant association between the distance from a digital device and the condition.

Taking preferred break after 30 min: P-values using Fisher's exact test showed less than 0.05, indicating statistically significant associations between taking breaks and the symptoms. This suggests that taking breaks while using digital devices is significantly associated with the occurrence of these conditions.

DISCUSSION

In present study, age-group > 11 yearswere included as it presents more appropriate statistical representation of population, and in today' era, all age-group people are using digital devices more frequently. The age groups involved in the study were 11-30 (43.4%), 31-40 (34%) and above 40 (22.6%) years.In thesestudy,60 % were females and 40% were males. Similar study conducted by **Touma S. et al (2020)**[4] at Beirut, Lebanon, the gender distribution was 55.4% males and 44.6% were females while **Khan A et.al (2019)** [3] in their study at Mangluru,Karnataka, India reported almost equal proportion of gender distribution.**In our study,the more common symptoms reported were headache (350,70%), watering (300,60%), and dry eyes (250,50%)**.Khan A et.al (2019)[3] (India) and N. Shantakumari et al(2014)[2].in their similar study at Ajman, UAE also reported headache as most common symptom in 73.33% and 53.3% of participants respectively while Tawil L[5]in his similar study at Saudi Arabia reported 66.5% subjects suffered from Headache and 51.5% had dry eye.

CONCLUSION

Dry eye, watering, headache, blurring of vision, and double vision show statistically significant differences in the prevalence between males and

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females. Most symptoms show a significant increase in the >40 years age group, indicating that these symptoms are more prevalent among older individuals, indicating that age likely influences these symptoms. All the symptoms were statistically significant associated with average time spent for digital device usage, taking preferred break after 30 minutes of continuous usage of digital device,approximate distance of digital device from eyes except foreign body sensation and double vision.

SOURCE OF FUNDING
None

CONFLICT OF INTEREST
None

REFERENCES

1. American Optometric Association. Computer vision syndrome. 2017. http://www.aoa.org/patients-and-public/caring-for-your-vision/protecting-your-vision/computer-vision-syndrome?ss0=y. Accessed 22 Feb 2022.
2. Shantakumari N, Eldeeb R, Sreedharan J, Gopal K. Computer use and vision-related problems among university students in Ajman, United Arab Emirate. Ann Med Health Sci Res. 2014;4(2):258–63. doi:10.4103/2141-9248.129058.
3. Khan AA, Jain R, Hegde V, Bappal A, Rashmi S. Digital eye strain among undergraduate medical students in a tertiary eye care hospital of south India - A questionnairebased study. Indian J Clin Exp Ophthalmol. 2019;5(2):208–10.
4. Musharrafieh U, Sawaya RT, Meski NE, Saba JB, Lahoud C, Saab L, et al. Asthenopia among university students: The eye of the digital generation. J Fam Med Prim Care. 2020;9(8):3921. doi:10.4103/jfmpc.jfmpc_340_20
5. Tawil LA, Aldokhayel S, Zeitouni L, Qadoumi T, Hussein S, Ahamed SS. Prevalence of selfreported computer vision syndrome symptoms and its associated factors among university students. Eur J Ophthalmol. 2020;30(1):189–95.