



**ORIGINAL RESEARCH PAPER**

**Ophthalmology**

**STUDY OF THE DIGITAL EYE STRAIN DUE TO EXTENSIVE DIGITAL DEVICE USE AMONG UNDERGRADUATE MEDICAL STUDENTS IN A TERTIARY CARE TEACHING HOSPITAL**

**KEY WORDS:**

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**INTRODUCTION**

Technology has transformed every realm of our lives in the information age, from healthcare to education. Prompt communication, extensive availability of information, and most imperative, going paperless or GO GREEN are various advantages. However, every action comes with its opposite reaction, and the digital revolution is no exemption from this rule. Digital eye strain includes a group of ocular and vision-related problems attributed to prolonged use of desktops, laptops, mobile phones, tablets, etc.

Its pathophysiology is multifocal, with several contributing factors being - reduced contrast level of letters compared to background digital screens, screen glare and reflections, wrong distance and angle of viewing digital screens, poor lighting conditions and infrequent blinking of lights.

The condition can cause various symptoms like eyestrain, watering of eyes, headache, tired eyes, burning sensation, red eyes, irritation, dry eye, foreign body sensation, blurred vision at near and diplopia.

The usage of digital devices continuously for two hours is adequate to bring about digital eye strain. However, during the recent outbreak of COVID-19 there has been an upsurge in the usage of digital devices. A major part of the world was compelled to be confined indoors and its effects could be visualized in various sectors. Due to the lockdown, most people resorted to the internet and internet-based services to communicate and continue with their job responsibilities from home. Working from home became the new norm of working for millions of employees worldwide.

Online learning services served as a remedy during the pandemic. There was a rise in usage of internet services from 40 to 100%, compared to pre-lockdown levels. Being restricted indoors, digital devices became the only source of entertainment. Ultimately this has resulted in an upsurge in the symptoms of digital eye strain amongst most individuals irrespective of age, sex, race, or region.

**MATERIAL & METHODS:**

A cross sectional study was conducted among randomly selected 100 undergraduate medical students of C. U. Shah Medical College & Hospital in Surendranagar using a predesigned questionnaire into their digital device use pattern, symptoms of DES experienced by them. Those who experienced one or more symptom related to digital device use were considered to have DES. Data collected was entered in Excel sheet and analysed. Descriptive statistics was expressed as frequency and percentage. Chi square and Fischer's exact tests were applied accordingly.

**RESULTS:**

The study indicated 80 % prevalence of DES among the students of which the prevalence among female & male were 37 % & 63 % respectively. 84 % students were using devices held <1.5 ft from the eyes. The digital device preference among the students was maximum (56 %) for smart phones, 24 % for laptops/computer and 20 % for Notepad/ ipad. 71 % students were using devices for >3 hours per day. Table 1 depicts the intensity of various symptoms of DES experienced by the respondents.

**Table 1: Prevalence of various symptoms of digital eye strain (n=100)**

Sr. No.	Ocular Symptoms	Severity of Symptoms (%)				
		None	Mild	Moderate	Severe	Very Severe
1	Burning Sensation	28	48	5	2	0
2	Itching	30	46	3	4	0
3	Foreign Body Sensation	37	43	3	1	0
4	Watering	23	45	11	2	2
5	Excessive Blinking	43	34	2	4	1
6	Redness	37	40	6	1	0
7	Pain	35	39	7	2	1
8	Heaviness	36	36	8	1	3
9	Dryness	52	21	6	1	2
10	Blurring of Vision	43	26	8	4	2
11	Double Vision	60	20	3	0	0
12	Difficulty in Focusing Near	51	25	5	1	0
13	Photophobia	42	30	5	5	1
14	Headache	25	40	15	2	1

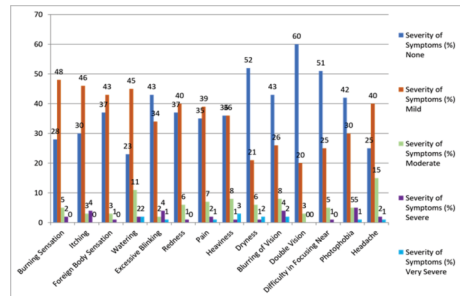
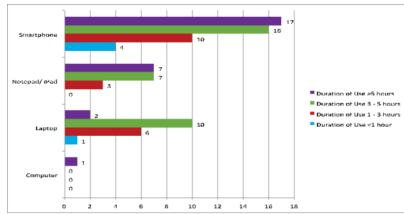


Table 2 & 3 shows the distribution of various factors associated with DES among the respondents.

**Table 2: Factor (s) associated with digital eye strain.**

	Duration of Use :	Frequency (n)	Percentage (%)
1	<1 hour	5	6
	1 - 3 hours	19	23
	3 - 5 hours	33	39
	>5 hours	27	32
2	Preferred device :		
	Computer	1	1
	Laptop	19	23
	Notepad/ iPad	17	20
3	Smartphone	47	56
	Distance from Eyes :		
	<1 ft	25	30
	1 to 1.5 ft	45	54
	1.5 to 2 ft	13	15
>2 ft	1	1	



**Table 3: Factor (s) associated with digital eye strain.**

Duration of use	Duration of Use				Grand Total
	<1 hour	1 - 3 hours	3 - 5 hours	>5 hours	
Female	3	10	11	7	31
Laptop	-	4	4	2	10
Notepad/iPad	-	2	-	3	5
Smartphone	3	4	7	2	16
Male	2	9	22	20	53
Computer	-	-	-	1	1
Laptop	1	2	6	-	9
Notepad/iPad	-	1	7	4	12
Smartphone	1	6	9	15	31
Grand Total	5	19	33	27	84

**DISCUSSION:**

**Prevalence**

In the present study, 80 % students stated experiencing the symptoms of DES. The prevalence of DES ranged from 53-73 % in several other studies on digital device users.

**Age/gender**

Mean age of 22.5 years and male predominance (63 %) for DES which was found in this study.

**Digital device preference**

Smartphones and laptops were the most frequently used devices reported in similar studies. Students used digital devices mainly for social networking and college projects.

**Symptoms**

In the present study, 55 % had burning sensation, 53 % had itching, 60 % had watering, 58 % had headache & 49 % had pain & heaviness in the eyes. Several other studies also reported watering & headache as the most common or disturbing symptoms following the use of digital devices.

**Factors associated with DES**

Use of the smart phone as digital screen had statistically significant association (<0.05) with having digital eye strain according to the present study. Duration of use and average distance from eyes were significantly associated with various symptoms of DES. Better ergonomic practices' knowledge and practicing the preventive measures is significantly associated with DES symptoms.

**CONCLUSION:**

Usage of digital devices for work and social purposes, often for many hours each day is now normal among individuals of all ages. While there are challenges in determining the prevalence of DES, levels of 50% or more have been reported in numerous published studies.

Digital device use in myriad forms ranging from smart phones to laptops lead to a high prevalence of a varied number of asthenopic symptoms collectively known as DES which is aggravated more due to inappropriate practices like inappropriate distance from digital screen & inappropriate duration of use.

Digital device usage of more than 4 hours/day, underlying refractive errors and prior dry eyes are the most significant risk factors predisposing to DES.

Awareness related to effects of excess screen time, ergonomic practices, and preventive measures needs to be spread especially among teachers, students and professionals exposed to excessive or prolonged screen time.

Better ergonomic practices like keeping the digital device at an arm's length or more than 1.5 ft, taking visual breaks from screen (20-20-20 rule) and having annual eye checkups are feasible solutions for such a public health concern.

With the high prevalence of DES and near-universal use of digital devices, it is paramount that the condition is considered by eye care practitioners and treatment options are supported by available research evidence.

**REFERENCES**

- American Optometric Association. Computer vision syndrome. 2017. <http://www.aoa.org/patients-andpublic/caring-for-your-vision/protecting-your-vision/computer-vision-syndrome?as0=y>. Accessed 22 Feb 2022.
- The Vision Council. Eyes overexposed: The digital device dilemma: digital eye strain report. 2016. <http://www.thevisioncouncil.org/content/digital-eye-strain>. Accessed 24 Feb 2022.
- Sheppard AL, Wolffsohn JS. Digital eye strain: prevalence, measurement and amelioration. *BMJ Open Ophthalmol*. 2018;3:e000146.
- PubMed Central Article Google Scholar 4. Németh J, Tapasztó B, Aclimandos WA, et al. Update and guidance on management of myopia. European Society of Ophthalmology in cooperation with International Myopia Institute. *Eur J Ophthalmol*. 2021;31(3):853-83.
- PubMed Central Article Google Scholar 5. Usgaonkar U, Shet Parkar SR, Shetty A. Impact of the use of digital devices on eyes during the lockdown period of COVID-19 pandemic. *Indian J Ophthalmol*. 2021;69(7):1901-6.
- PubMed Central Article Google Scholar <https://www.aoa.org/eye-health/tips-prevention/computer-usage>. 2022. Accessed 10 June 2022.
- Hashim JH, Adman MA, Hashim Z, Mohd Radi MF, Kwan SC. COVID-19 epidemic in Malaysia: epidemic progression, challenges, and response. *Front Public Health*. 2021;7(9):560592.
- Article Google Scholar 8. De' R, Pandey N, Pal A. Impact of digital surge during Covid-19 pandemic: a viewpoint on research and practice. *Int J Inf Manag*. 2020;55:102171. Article Google Scholar
- Dain SJ, McCarthy AK, Chan-Ling T. Symptoms in VDU operators. *Am J Optom Physiol Opt*. 1988;65(3):162-7.
- CAS PubMed Article Google Scholar 10. Loh K, Redd S. Understanding and preventing computer vision syndrome. *Malays Fam Physician*. 2008;3(3):128-30.
- PubMed Central Google Scholar 11. Auffret É, Gomart G, Bourcier T, Gaucher D, Speeg-Schatz C, Sauer A. Perturbations oculaires secondaires à l'utilisation de supports numériques. Symptômes, prévalence, physiopathologie et prise en charge. *JFr Ophtalmol*. 2021;44(10):1605-10.
- CAS PubMed Article Google Scholar 12. Jaiswal S, Asper L, Long J, Lee A, Harrison K, Colebiowski B. Ocular and visual discomfort associated with smartphones, tablets and computers: what we do and do not know. *Clin Exp Optom*. 2019;102(5):463-77.
- PubMed Article Google Scholar 13. Sheedy JE, Hayes JN, Engle J. Is all asthenopia the same? *Optom Vis Sci*. 2003;80(11):732-9.
- PubMed Article Google Scholar 14. Portello JK, Rosenfield M, Bababekova Y, Estrada JM, Leon A. Computer-related visual symptoms in office workers. *Ophthalmic Physiol Opt*. 2012;32(5):375-82.
- PubMed Article Google Scholar 15. Shukla Y. Accommodative anomalies in children. *Indian J Ophthalmol*. 2020;68(8):1520-5.
- PubMed Central Article Google Scholar 16. Hakala PT, Saarni LA, Punamäki R-L, Wallenius MA, Nygård C-H, Rimpelä AH. Musculoskeletal symptoms and computer use among Finnish adolescents - pain intensity and inconvenience to everyday life: a cross-sectional study. *BMC Musculoskelet Disord*. 2012;13(1):41.
- PubMed Central Article Google Scholar 17. Mohan A, Sen P, Peeush P, Shah C, Jain E. Impact of online classes and home confinement on myopia progression in children during COVID-19 pandemic: digital eye strain among kids (DESK) study 4. *Indian J Ophthalmol*. 2022;70(1):241-5.
- PubMed Article Google Scholar 18. Blehm C, Vishnu S, Khattak A, Mitra S, Yee RW. Computer vision syndrome: a review. *Surv Ophthalmol*. 2005;50(3):253-62.