

Headache Severity and Digital Eye Strain Among Call Centre Agents: The Impact of Prolonged Screen Time on Work Productivity

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Abstract

Background: The rapidly growing call centre industry in Pakistan, particularly in Rawalpindi and Islamabad, has drawn large numbers of young people into prolonged, screen-intensive work. Extended occupational screen time, compounded by recreational use of digital devices, has been associated with a rise in digital eye strain (DES). While prior studies have documented the prevalence of DES symptoms in this population, none have specifically examined symptom severity or its relationship with headache and work productivity.

Objectives: To identify the symptoms and prevalence of digital eye strain among call centre agents, assess the severity of symptoms in relation to screen time, evaluate the association between digital eye strain and headache, and determine the impact of symptom severity on work productivity.

Methods: A cross-sectional survey was conducted using a convenience sample of 348 call centre agents, with sample size calculated using the OpenEpi tool. Data were collected between April and July from H&M Telesolutions, Mars BPO, and other call centres in Rawalpindi and Islamabad, using the Digital Eye Strain Questionnaire (DES-Q) together with a self-generated questionnaire. Data were analysed using IBM SPSS 21.

Results: Participants aged 26–35 years, predominantly male, reported the highest burden of digital-eye-strain symptoms, which were strongly linked to prolonged screen time and non-work device use. Headache showed a highly significant association with digital eye strain ($p < .001$) and had only a slight measurable effect on work productivity.

Conclusion: Prolonged screen time among call centre agents is associated with digital eye strain, most commonly presenting as headache, blurred vision, and burning of the eyes, and headache severity is strongly linked to overall symptom severity. Although the impact on work productivity was slight, most participants regarded these symptoms as ordinary, rarely sought professional care, and allowed symptoms to resolve on their own.

INTRODUCTION

DES is a condition that includes all visual and ocular complaints resulting from the increased use of the digital electronic device for long periods. This condition is defined by symptoms such as dry eyes, irritation, foreign body sensation, tearing, blurriness, and headache (Kaur, 2020). These symptoms can be grouped into three main categories. The first category involves ocular surface symptoms as a result of dry eye and decreased blink rate, such as irritation or burning, dry eye, eye strain, headache, eye fatigue, photosensitivity, and overall eye discomfort. Accommodation/vergence symptoms are caused by the increased demand of close work on the binocular visual system, and it consists of blurry vision, both near and far, after working on a computer, difficulties in focusing between distances, and diplopia. Myopia progression has also been linked to digital eye strain in children. This association appears to be unique to the paediatric population; while evidence is accumulating, further work is needed before it can be firmly placed within the broader DES symptom complex (Hasan, 2025; Kaur, 2020).

Despite improvements in the management of headaches, many people suffering from migraines experience insufficient relief through their acute or preventive therapies, which leads to increased disability and suffering (Hasan, 2023). The use of terms such as "refractory" or "intractable" headache to refer to this presentation is known to exist; however, there is no widely accepted definition for these conditions. It should be noted that ICHD does not provide definitions of refractory migraine or any primary headache disorder. The European Headache Federation previously defined refractory migraine as a chronic migraine that is resistant to an adequate dose of at least three drug classes, including beta-blockers, anticonvulsants, tricyclics, onabotulinumtoxinA, and some other drugs such as flunarizine or candesartan for a minimum period of three months without medications overuse. Recent attempts at consensus on defining this condition attempt to critically revise this definition and provide the basis for pathophysiological interpretation and future therapy development (Khan et al., 2025; Sacco, 2020).

Two clusters were found by Portello et al., related to the computer use symptoms of accommodation (difficulty in focusing both near and far away after computer use) and dry eyes (eye irritation/burning, dry eyes, eye fatigue/stress, tired eyes, headache, light sensitivity, and eye discomfort) (Sheppard & Wolffsohn, 2018).

Management of computer vision syndrome is based on education and prevention. This management includes:

- Correcting any underlying refractive error.
- Conceivable use of computer eyewear or blue-blocking lenses, which have been found to decrease discomfort in a 15-week study of 79 VDT users, and enhance vision function in another of 23 participants within four weeks, even though further trials, particularly randomized controlled trials (RCTs), may be required.
- Guaranteeing adequate screen luminance (one-third at least of ambient room luminance), using flat screens and glare-reducing screens; the filters on the screen have also proven effective for increasing function in myopic children at school after 30 minutes of working on a computer.

- Staying at prescribed viewing distances from the screen – 30 cm from the phone, 60 cm from the computer screens, and 3 meters from the TV set, with 30- 40 inches from the screen making it easy for the eyes to relax.
- Correcting the viewing angle to about 15° below the horizontal plane and sitting properly to minimize discomfort.
- Using shorter breaks frequently (5 to 10 minutes) instead of less frequent long breaks and using the 20-20-20 rule where you look at something that is 20 feet away from you for 20 seconds every 20 minutes to avoid eye fatigue.
- Use lubricating eye drops for eye strain, dryness, and focusing problems while using computers for extended periods of time (Basur, 2024).

SIGNIFICANCE / RATIONALE OF THE STUDY

Many studies have shown the frequency of computer vision syndrome in call centre employees and those professions that include extensive screen exposure. However, there has been no study to investigate the severity of symptoms in the case of headache and its impact on work productivity in this field. The expansion of the call centre business in Rawalpindi and Islamabad, which is attracting many young people to the profession involving extensive use of screens, makes this investigation significant for the field.

REVIEW OF LITERATURE

Cabrera & Siong (2010) conducted a survey on 277 call center employees in Metro Manila (mean age 24.56 ± 4.14 ; males 47%, females 53%) and discovered that eye strain or fatigue (68%), headaches (66%) and blurred vision (53%) were the most frequent; all except headaches disappeared in one hour. Gloria et al. (2017) conducted a situational analysis of visual ergonomics and ocular symptoms among call centre agents in Tshwane and found that 61.7% of participants viewed their screens from a distance greater than the recommended 50–70 cm (Islam et al., 2026; Tamenti, 2017).

The symptoms stated by Shitole & Deshmukh (2017), in a survey conducted among 180 call center employees in Pune, were eye strain (67.2%), headache (66.7%), and blurring of vision (56.7%). The intensity of the symptoms increased with increased computer usage

Singh et al. (2021) studied the ability of blue-light-blocking lenses to alleviate the ocular symptoms of eye strain due to computer use and found no side effects of wearing them.

Neupane et al. (2017) in their systematic review of text neck syndrome noted great variability in the measures of neck pain and disability used by various studies, along with the increased prevalence of this condition (Chaudhari, 2026).

Chanda et al. (2013) examined behavioral markers for photophobia and ipsilateral head pain caused by stress in transgenic Cacna1a mutant mice and reported that there is evidence for lateralized head pain due to stress.

Oodith & Parumasur (2012) at University of KwaZulu-Natal (Westville Campus), Durban, showed that sick building syndrome had a great impact on the efficiency and well-being of call center employees (Islam et al., 2025).

In a cross-sectional study by Yasir et al. (2023), Digital Eye Strain was studied among staff and students of a medical college. DES is very common, and some major contributing features are female sex, age, screen time, dry eye, and refractive errors.

The experiment carried out by Martin et al. (2006), which investigated noise as a causative factor of headache in three phases (before intervention, during intervention, after intervention) in the laboratory setting showed that there exists a curvilinear association between exposure and pain reaction in subjects without a headache.

Call centre employees of telecommunication companies in Taiwan have been identified by Lin et al. (2009) to be experiencing whole body aches due to working in call centres for extended periods (odds ratios of 1.65 to 2.1

Diaz et al. (2007) observed that in a randomized stove intervention experiment among Guatemalan Mayan women, eye irritation, headache, and backache were significantly less prevalent among the intervention group than controls (95% CI 0.42–0.94).

A study by Kelman and Rains (2005) investigated sleep habits in a clinical sample of people with migraines and found that people who slept six hours were prone to having headaches upon awakening (Akhter, 2023).

According to Tripathi et al. (2022), in relation to dry eye disease associated with digital screen use in medical students, the following results were obtained using the OSDI questionnaire: 59% (n = 47) were normal, 28% (n = 21) were mild, 11% (n = 9) were moderate, and 2% (n = 2) were severe.

MATERIALS AND METHODOLOGY

STUDY DESIGN

This research utilized a cross-sectional survey approach. The study conducted by Awara et al. (2018) investigated the ocular surface changes in visual display terminal users and revealed that the placement of VDT in relation to eyes and lighting conditions influenced the ocular surface condition.

SAMPLING TECHNIQUE

A convenience sampling technique was used.

STUDY SETTINGS

Delve Business Network, IBEX Call Centre, Chinese Call Centre, Dotcom BPO, Supra BPO, Mars BPO, Ravon, Meta Link BPO, Globe Call Centre, and H&M Telesolutions.

SAMPLE SIZE

The sample size was calculated using the OpenEPI tool. The combined population of Rawalpindi and Islamabad is approximately 4.7 million, of which 52% falls within the working-age group defined by the study's inclusion criteria.

Start	Enter	Results	Examples	Help
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Sample Size for Frequency in a Population	
Population size(for finite population correction factor or fpc)(N):	3667
Hypothesized % frequency of outcome factor in the population (p):	50%+/-5
Confidence limits as % of 100(absolute +/- %)(d):	5%
Design effect (for cluster surveys-DEFF):	1
Sample Size(n) for Various Confidence Levels	
ConfidenceLevel(%)	Sample Size
95%	348
80%	158
90%	253
97%	418
99%	562
99.9%	837
99.99%	1072

Equation
Sample size $n = [DEFF * Np(1-p)] / [(d^2/Z^2_{1-\alpha/2} * (N-1) + p * (1-p)]$

Results from OpenEpi, Version 3, open source calculator--SSPropor
Print from the browser with ctrl-P
or select text to copy and paste to other programs.

STUDY DURATION

Data collection took place over four months following synopsis approval.

INCLUSION CRITERIA

- Both genders.
- Age 18–45 years.
- Work duration of 6–10 hours per day.
- Minimum of 3 months' work experience.

EXCLUSION CRITERIA

- Pre-existing eye problems.
- Recent ocular surgery or injury.
- Congenital eye problems.

TOOLS

For this study, the DES-Q (Harshika et al., 2023) was combined with a self-created questionnaire. The DES-Q was reliable and internally consistent (Cronbach's $\alpha = 0.94$), had reasonable test-retest reliability (ICC = 0.77; Mylona et al., 2022), and was highly valid (ICC = 0.86, 95% CI 0.8

ETHICAL CONSIDERATIONS

The written consent of all respondents was obtained before conducting data collection. No form of coercion was used in involving participants in the study, while their confidentiality remained intact throughout the process. In addition, none of the participants were subjected to any psychological, physical, or emotional injury.

RESULTS AND DISCUSSION

DEMOGRAPHIC AND WORK-PATTERN CHARACTERISTICS

Category	n	%
18–25 years	153	44.0
26–35 years	175	50.3
36–45 years	20	5.7
Total	348	100.0

Table 4.1.1: Age Distribution

The largest age group was 26–35 years (50.3%, n = 175), followed by 18–25 years (44.0%, n = 153).

Category	n	%
Male	236	67.8
Female	112	32.2
Total	348	100.0

Table 4.1.2: Gender Distribution

Male participants (67.8%, n = 236) outnumbered female participants (32.2%, n = 112) by more than two to one.

Category	n	%
Less than 2 hours	23	6.6
2–4 hours	46	13.2
4–6 hours	30	8.6
More than 6 hours	249	71.6
Total	348	100.0

Table 4.1.3: Daily Working Hours

Most participants (71.6%, n = 249) worked more than 6 hours per day on screen.

Category	n	%
Yes	263	75.6
No	85	24.4
Total	348	100.0

Table 4.1.4: Non-Work Use of Digital Devices

Three-quarters of participants (75.6%, n = 263) also used digital devices for non-work purposes.

Category	n	%
Yes	116	33.3
No	232	66.7
Total	348	100.0

Table 4.1.5: Use of Antiglare / Blue-Light Filters

Only a third of participants (33.3%, n = 116) used antiglare or blue-light-filtering glasses or screens.

Category	n	%
Yes	159	45.7
No	189	54.3
Total	348	100.0

Table 4.1.6: Regular Breaks During Screen Use

More than half of participants (54.3%, n = 189) did not take regular breaks during screen use.

Category	n	%
Not at all	145	41.7
Slightly	135	38.8
Moderately	46	13.2
Significantly	22	6.3
Total	348	100.0

Table 4.1.7: Perceived Effect of Symptoms on Work Productivity

Most participants reported no (41.7%) or only slight (38.8%) impact of symptoms on their work productivity; a minority (6.3%) reported a significant impact.

Category	n	%
Yes	122	35.1
No	226	64.9
Total	348	100.0

Table 4.1.8: Professional Help Sought

Nearly two-thirds of participants (64.9%, n = 226) did not seek professional help for their symptoms.

Category	n	%
Resting the eyes	158	45.4
Reducing screen time	90	25.9
Eye drops	41	11.8
Adjusting posture / using glasses	44	12.6
Other	15	4.3
Total	348	100.0

Table 4.1.9: Methods Used to Relieve Symptoms

Resting the eyes (45.4%) and reducing screen time (25.9%) were the most common self-management strategies.

SEVERITY OF DIGITAL EYE STRAIN AND HEADACHE SYMPTOMS

Symptom severity was rated on a five-point scale (never, mild, moderate, severe, very severe) unless otherwise noted.

Category	n	%
Mild	215	61.8
Moderate	108	31.0
Severe	25	7.2
Total	348	100.0

Table 4.1.10: Overall Severity of Eye Strain and Headache

Most participants reported mild overall symptom severity (61.8%), with only 7.2% reporting severe symptoms.

Category	n	%
Never	91	26.1
Mild	130	37.4
Moderate	70	20.1
Severe	25	7.2
Very severe	32	9.2
Total	348	100.0

Table 4.1.11: Headache Associated with Near Work

Headache with near work was most often mild (37.4%); 26.1% reported none at all.

Category	n	%
Never	128	36.8
Mild	86	24.7
Moderate	83	23.9
Severe	27	7.8
Very severe	24	6.9
Total	348	100.0

Table 4.1.12: Headache associated with far vision

More than a third of participants (36.8%) reported no headache associated with far vision, the largest single category.

Category	n	%
Never	93	26.7
Mild	108	31.0
Moderate	76	21.8
Severe	41	11.8
Very severe	30	8.6
Total	348	100.0

Table 4.1.13: Eye Fatigue Associated With Near Work

Eye fatigue with near work was most often mild (31.0%), followed closely by no fatigue at all (26.7%).

Category	n	%
Never	116	33.3
Mild	79	22.7
Moderate	91	26.1
Severe	30	8.6
Very severe	32	9.2
Total	348	100.0

Table 4.1.14: Eye Fatigue Associated With Far Work

A third of participants (33.3%) reported no eye fatigue with far work, though moderate fatigue was also common (26.1%).

Category	n	%
Never	124	35.6
Mild	95	27.3
Moderate	77	22.1
Severe	34	9.8
Very severe	18	5.2
Total	348	100.0

Table 4.1.15: Blurred vision at near work

Just over a third of participants (35.6%) reported no blurred vision at near work.

Category	n	%
Never	106	30.5
Mild	99	28.4
Moderate	72	20.7
Severe	41	11.8
Very severe	30	8.6
Total	348	100.0

Table 4.1.16: Blurred Vision At Far Work

Blurred vision at far work was fairly evenly split between none (30.5%) and mild (28.4%).

Category	n	%
Never	130	37.4
Mild	78	22.4
Moderate	70	20.1
Severe	45	12.9
Very severe	25	7.2
Total	348	100.0

Table 4.1.17: Watery Eyes At Near Work

More than a third of participants (37.4%) reported no watery eyes at near work.

Category	n	%
Never	132	37.9
Mild	94	27.0
Moderate	63	18.1
Severe	34	9.8
Very severe	25	7.2
Total	348	100.0

Table 4.1.18: Watery Eyes At Far Work

Watery eyes at far work followed a similar pattern, with 37.9% reporting none.

Category	n	%
Never	138	39.7
Mild	90	25.9
Moderate	70	20.1
Severe	26	7.5
Very severe	24	6.9
Total	348	100.0

Table 4.1.19: Double Vision Associated With Near Work

Double vision with near work was uncommon overall, with 39.7% reporting none.

Category	n	%
Never	137	39.4
Mild	93	26.7
Moderate	50	14.4
Severe	46	13.2
Very severe	22	6.3
Total	348	100.0

Table 4.1.20: Double Vision Associated With Far Work

Similarly, 39.4% reported no double vision with far work, though a notable 13.2% rated it severe.

Category	n	%
Never	113	32.5
Mild	95	27.3
Moderate	86	24.7
Severe	41	11.8
Very severe	13	3.7
Total	348	100.0

Table 4.1.21: Flashes of Light

Flashes of light were absent in 32.5% of participants, with the remainder spread fairly evenly across mild and moderate severity.

Category	n	%
Never	101	29.0
Mild	62	17.8
Moderate	140	40.2
Severe	29	8.3
Very severe	16	4.6
Total	348	100.0

Table 4.1.22: Eye Strain With Near Work

Eye strain with near work was predominantly moderate (40.2%), the highest single-category rate among all near-work symptoms assessed.

Category	n	%
Never	96	27.6
Mild	121	34.8
Moderate	80	23.0
Severe	35	10.1
Very severe	16	4.6
Total	348	100.0

Table 4.1.23: Eye strain with far work

Eye strain with far work was most often mild (34.8%).

Category	n	%
Never	129	37.1
Mild	91	26.1
Moderate	67	19.3
Severe	38	10.9
Very severe	23	6.6
Total	348	100.0

Table 4.1.24: Redness around the eyes

Just over a third of participants (37.1%) reported no redness around the eyes.

Category	n	%
Never	119	34.2
Mild	82	23.6
Moderate	79	22.7
Severe	47	13.5
Very severe	21	6.0
Total	348	100.0

Table 4.1.25: Eye pain with near work

Eye pain with near work was reported as absent by 34.2% of participants, with the remainder spread across mild to very severe.

Category	n	%
Never	134	38.5
Mild	89	25.6
Moderate	74	21.3
Severe	31	8.9
Very severe	20	5.7
Total	348	100.0

Table 4.1.26: Eye pain with far work

More than a third of participants (38.5%) reported no eye pain with far work.

Category	n	%
Never	140	40.2
Mild	85	24.4
Moderate	77	22.1
Severe	23	6.6
Very severe	23	6.6
Total	348	100.0

Table 4.1.27: Difficulty tracking objects – near work

Difficulty tracking objects during near work was the least commonly reported near-work symptom, with 40.2% reporting none.

Category	n	%
Never	134	38.5
Mild	96	27.6
Moderate	67	19.3
Severe	26	7.5
Very severe	25	7.2
Total	348	100.0

Table 4.1.28: Difficulty tracking objects – far vision

Similarly, 38.5% of participants reported no difficulty tracking objects during far vision tasks.

Category	n	%
Never	151	43.4
Mild	89	25.6
Moderate	62	17.8
Severe	30	8.6
Very severe	16	4.6
Total	348	100.0

Table 4.1.29: Burning sensation – near work

Burning sensation with near work was the least prevalent symptom overall, with 43.4% reporting none.

Category	n	%
Never	146	42.0
Mild	103	29.6
Moderate	45	12.9
Severe	42	12.1
Very severe	12	3.4
Total	348	100.0

Table 4.1.30: Burning sensation – far work

Burning sensation with far work followed the same pattern, with 42.0% reporting none.

STATISTICAL ASSOCIATIONS

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	59.328 ^a	16	<.001
Likelihood Ratio	59.878	16	<.001
Linear-by-Linear Association	22.094	1	<.001
N of Valid Cases	348		

Table 4.1.31: Association between headache and eye strain – near work

Headache and eye strain at near work were highly significantly associated ($\chi^2 = 59.328$, $df = 16$, $p < .001$).

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	55.461 ^a	16	<.001
Likelihood Ratio	56.289	16	<.001
Linear-by-Linear Association	39.645	1	.000
N of Valid Cases	348		

Table 4.1.32: Association between Headache and Eye Strain – Far Work

Headache and eye strain at far work showed an equally strong association ($\chi^2 = 55.461$, $df = 16$, $p < .001$).

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.970 ^a	6	<.002
Likelihood Ratio	8.230	6	.222
Linear-by-Linear Association	.427	1	.513
N of Valid Cases	348		

TABLE 4.1.33: Association between Symptom Severity and Working Hours

Symptom severity was significantly associated with working hours on the Pearson chi-square test ($p < .002$), although the likelihood-ratio and linear-by-linear estimates did not reach significance, suggesting a weaker or non-linear relationship.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	26.082 ^a	6	<.001
Likelihood Ratio	24.320	6	.000
Linear-by-Linear Association	15.814	1	.000
N of Valid Cases	348		

Table 4.1.34: Association between symptom severity and work productivity

Symptom severity was highly significantly associated with self-reported work productivity across all three test statistics ($p < .001$).

SUMMARY OF KEY FINDINGS

On combining these findings, it becomes clear that the individuals were mostly between the age group of 26 to 35 years and were males, spent more than six hours per day on their screens, and made frequent use of digital gadgets not only at work but also during leisure time but did not have any protective eyewear or took rest breaks. The intensity of symptoms reported on all the scales used was relatively low and mostly fell under mild-to-moderate level except for burning sensation which was the least reported one. Eye strain reported during near work was highest followed by far vision work and there was a significant association between eye strain and headache. Also, symptom severity had a significant relationship with work productivity.

DISCUSSION

Participants were between the ages of 18 and 45, and the most affected group (26-35 years) differed from another study done in Riyadh, Saudi Arabia, in which a different age group was found to be at the highest risk (Maneea, 2024). The males were the most affected group compared to a study done in Colombia in which females were the most affected group (Muñoz-Cerón, 2018).

Eye strain and headaches turned out to be the most important symptoms in the present study where the former had a rating of moderate for near work and mild for far work while the latter was also classified as mild for near work and absent for far work. This is similar to the findings of another study done at Army Medical College where mild-level eye strain and headache were reported (Maroof, 2019). Eye strain and headache were found to be highly correlated ($p < .001$) at near and far working distances.

Increased screen time and device usage outside of work were identified as the most significant factors leading to eye strain and headaches, along with a partial effect on work efficiency. Many individuals suffering from headache, burning feeling, blurring of vision, or tearfulness did not visit professionals but allowed the issue to heal by itself; furthermore, many individuals did not take breaks that could help improve the situation.

Severity of symptoms depended on the time of screen use per day, and headache was the most common symptom among all the symptoms associated with digital eye strain, just like it was reported before in this topic. Eye fatigue while

performing tasks at close distance was another most common symptom, similarly to findings reported previously in other research in this field. Burning sensation and blurred vision were also common symptoms in the current sample (Maneea, 2024).

CONCLUSION

This study intended to assess the prevalence of symptoms of digital eye strain and headaches among call centre agents and the association of these with working hours and work productivity. The results reveal that symptoms of digital eye strain such as blurring of vision, burning of the eyes, redness, fatigue of eyes, and headache are very common among call centre agents who are exposed to screens for long periods. There is a strong association of digital eye strain and headache, and this is associated with a slight decrease in work productivity probably due to working long hours. The majority of the participants did not take any breaks regularly or seek professional help, but resorted to simple management methods like taking rest of the eyes or reducing exposure to screens; usage of digital screens recreationally also contributed to the increased burden of symptoms.

LIMITATIONS

- Data were collected only from Rawalpindi and Islamabad, limiting generalisability to other regions.
- The impact on work productivity was captured through perception-based questions and was not quantitatively measured.
- Individuals with pre-existing eye conditions were excluded, which may have omitted a significant segment of the affected population.
- Data collection was constrained by permission issues at some call centre sites.
- Lower literacy among some participants may have affected the accuracy of self-reported responses.

RECOMMENDATIONS

- Use objective tools to measure work productivity rather than relying solely on self-report.
- Recruit a larger, more diverse sample across different cities and professions.
- Incorporate clinical eye examinations alongside self-report questionnaires.
- Compare digital eye strain across other occupational groups, such as students or office workers.

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