



## Effectiveness of the 20-20-20 Rule in Reducing Digital Eye Strain among Adults with Prolonged Screen Exposure: A Prospective Observational Study

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### Abstract

**Background:** Digital eye strain (DES) has become highly common concern because of the extensive application of digital devices in the workplace, school, and entertainment. Interventions procedures like the 20-20-20 rule were used. This study intends to determine the 20-20-20 rule result in reducing the adverse effect of digital eye strain in people with extended time on the screen.

**Methods:** This prospective observational study was conducted over one year in the ophthalmology outpatient department of a tertiary care hospital in Uttar Pradesh to assess the effectiveness of the 20-20-20 rule in reducing digital eye strain among adults with more than four hours of daily screen exposure. Eligible participants aged 18–60 years underwent baseline questionnaire-based assessment, followed by implementation of the intervention and reassessment at six months and one year. Statistical analysis was performed using SPSS with predefined significance criteria.

**Results:** The findings indicate predominant mobile device usage among participants (140 vs 40 computer users), with most individuals taking regular breaks during screen use (169 vs 11;  $p < 0.01$ ). Dry eye symptoms were significantly associated with screen exposure (72 vs 108;  $p = 0.003$ ), whereas headache showed a borderline association (100 vs 80;  $p = 0.053$ ). Implementation of the 20-20-20 rule resulted in higher symptom relief (105 vs 75;  $p = 0.004$ ), and maintaining adequate viewing distance further enhanced relief (140 vs 40;  $p = 0.001$ ).

**Conclusion:** The study has concluded that adherence to the 20-20-20 rule is significantly associated with reduction in key symptoms of digital eye strain, particularly dry eyes, headache, ocular irritation, and visual fatigue, among adults with prolonged screen exposure.

**Keywords:** Digital eye strain, 20-20-20 rule, prolonged screen exposure, visual fatigue, occupational ophthalmology

### Introduction

Several eye and vision problems have been linked to prolonged use of computers; the complaints relating to the eye have been collectively referred to as computer vision syndrome, or more generally, digital eye strain (DES). DES has become more common with the advent of new technologies. The most recent reports have found the prevalence to be between 65% and 33% - a broad range is likely to come as a result of the variety of methods used to

determine sufferers and the varying classes of the population studied; it is likely to be highest in young adults, with a prevalence of 74 to 77% [1, 2].

Symptoms of DES on the eye are frequently divided into two major and different groups, depending on the nature of the sensation and the location experienced. The first one, which is known as external symptoms, is associated with

dry eye and encompasses burning, dryness, irritation, discomfort, foreign body sensation, tearing, and sensitivity to bright lights. The second category is known as internal symptoms, and it includes diplopia, headache, eye ache, difficult refocusing, eyestrain, and blurred vision, and is associated with binocular vision stress [3, 4].

As remote work has been extensively proliferating, online education and online entertainment, DES is becoming more widespread, especially among working adults, students, as well as those individuals who are in the habit of performing protracted performances on their screens. Symptoms are aggravated by factors like poor blinking, poor posture, over-brightness of the screen, and poor breaks [5]. Although its prevalence is increasing, little awareness of DES prevention, symptom recognition, and management measures is available. Misconceptions regarding exposure to digital screens in combination with the absence of eye care measures tend to cause people to overlook the initial symptoms of DES that can cause increased risk of pain and loss of vision [6, 7].

DES greatly depends on the visual demand and the time to take to finish a specific task. Indicatively, Portello *et al.*, found a positive relationship between the symptom score and the duration of time working on a computer. In that regard, it can be assumed that the restriction of time in front of a digital display will positively affect DES [5]. According to this principle, regular screen users are usually encouraged to adhere to the 20-20-20 rule that states that after every 20 minutes of uninterrupted work, one should take a glance away from the screen at least 20 s, at least 20 feet (6 m), and at least 20 minutes to a distant view. This general principle of visual ergonomics has grown in popularity alongside the introduction of display use and is strongly advised by experts in the vision field, though only a single study has been conducted looking at this solution, which found a benefit, but no evidence of adherence [6, 7].

## Methods

## Study design

This was a prospective observational study that aimed to determine the effectiveness of the 20-20-20 rule in reducing digital eye strain (DES). The study was performed in the Ophthalmology Outpatient Department of a tertiary care hospital in UP with the consent of the Institutional Ethics Committee. The study duration was 1 year, from December 2019 to November 2020 with follow up at 6 months and 1 year. The participants in the study were the doctors, nurses, students, and patients attending the outpatient department who reported having used digital screens more than 4 hours a day.

## Inclusion criteria

1. Patients between 18-60 years of age
2. Use of digital screens like smartphones, computers, tablets, etc., for more than 4 hours
3. Patients who are willing to participate in the study

## Exclusion criteria

1. Patients who are not willing to follow the 20-20-20 rule.
2. Existence of visual abnormalities such as glaucoma, which impacts eye strain.
3. Patients who have had contact lenses and with a history of refractive surgery in the past.

## Questionnaire and baseline examination

Eligible individuals were recruited and requested to fill out a structured questionnaire on the baseline (Day 0). The following information was obtained in the questionnaire.

1. Demographic data
2. Presence of systemic diseases such as Diabetes, thyroid disorders, hypertension
3. Details of screen usage: Type of device used, average time of screen usage
4. Presence or absence of asthenopic symptoms
  - a. Dry eyes
  - b. Headache
  - c. Blurred vision
  - d. Sensitive to bright light
  - e. Ocular discomfort
  - f. Irritation of the ocular surface

### g. Strain on the eyes

The questionnaire was obtained from previous studies to evaluate visual fatigue; however, the questionnaire had not been validated. This is a drawback of the study; the next study should use validated measures, including the Computer Vision Syndrome Questionnaire (CVS-Q) or the Ocular Surface Disease Index (OSDI).

### Intervention: the 20-20-20 rule

Once the baseline assessment was done, the participants were to be provided with the 20-20-20 rule, i.e., 20-second intervals after every 20 minutes of screen time, during which they needed to focus on an object that was not less than 20 feet distant. To help maintain compliance, the participants were recommended to place notes on their phones or make use of mobile applications that are specifically created to do so.

### Follow up

The reassessment of the participants was conducted at 6 months and 1 year after the start of the intervention.

1. The same questionnaire was used as at baseline, with further questions on the degree of adherence and assessment of asthenopic symptom changes also done at 6 months.
2. Participants were asked to fill in the questionnaire again after 1 year to determine the changes in symptoms, i.e., whether the

symptoms improved or not, or whether they got worse. The compliance with the rule was re-evaluated at this stage.

### Assessment of adherence

Adherence was measured on the basis of the following question: “How often were you able to adhere to the 20-20-20 rule? and the following response categories:

1. Always ( $\geq 90\%$  of the time)
2. Frequently (50–89% of the time)
3. Occasionally (10–49% of the time)
4. Rarely ( $< 10\%$  of the time)

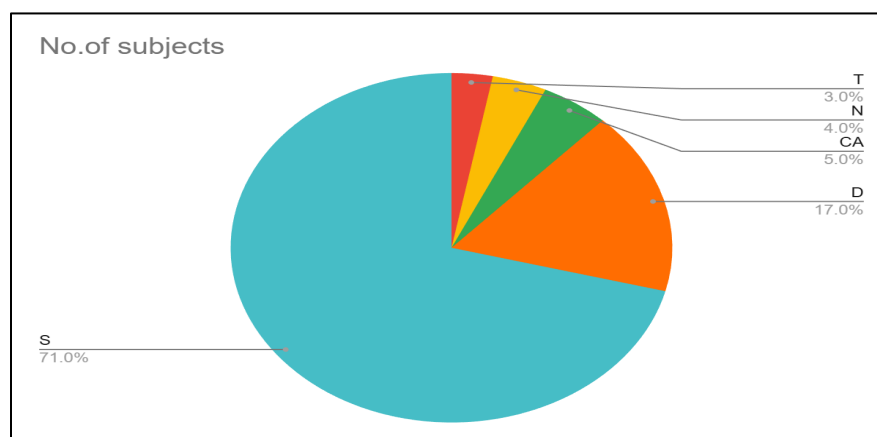
The participants were also questioned on whether they used reminders (e.g., phone alarms or apps) to aid them in being adherent.

### Statistical analysis

SPSS version 25 was used to analyze data. The Chi-square test was used to compare categorical variables, and the Student t-test was used to compare continuous variables. A p-value that was lower than 0.05 was regarded as significant.

### Results

Figure 1 shows the proportion of the study participants based on their occupation. Most of the participants were students (S), contributing 71% of the total population. It was then followed by doctors (D), who comprised 17%. The lower percentages were recorded in chartered accountants (CA) at 5%, nurses (N) at 4%, and teachers (T) at 3%.



**Figure 1: Distribution of participants based on occupation**

Table 1 shows that the majority of participants were users of mobile devices, with 140 subjects reporting mobile usage compared with 40

subjects using computers, indicating a markedly higher exposure to handheld digital devices within the study population.

**Table 1: Usage of digital devices in this study**

Digital device used	No.of subjects
Mobile/ Tablets	140
Computers/Desktops/Laptops	40
Total	180

Table 2 shows that breaks during device usage were practiced by a substantial proportion of participants, with 169 subjects reporting taking

breaks compared with only 11 who did not, reflecting a statistically significant tendency toward preventive behavior ( $p < 0.01$ ).

**Table 2: Breaks taken by the participants during the usage of the device**

Breaks during usage of devices	Number of subjects	p- value
Yes	169	<0.01
No	11	

Table 3 shows that irritated or burning eyes were reported by 86 participants, while 94 did not experience this symptom, with no statistically significant difference observed ( $p = 0.256$ ). The same table shows that blurred vision during screen use was reported by 30 participants compared with 150 without this complaint, indicating no significant association ( $p = 1.2$ ). It

also shows that headache after prolonged screen exposure was present in 100 participants versus 80 without headache, demonstrating a borderline association ( $p = 0.053$ ), whereas dry eyes were reported by 72 participants and were significantly associated with screen time when compared with 108 asymptomatic individuals ( $p = 0.003$ ).

**Table 3: Symptoms associated with screen time**

Symptom	Yes (number of subjects)	No (number of subjects)	p- value
Irritated burning eyes	86	94	0.256
Blurred vision while using the screen	30	150	1.2
Headache after long-term exposure to the screen	100	80	0.053
Dry eyes	72	108	0.003

Table 4 shows that adherence to the 20-20-20 rule resulted in symptom relief in 105 participants compared with 75 who did not

report relief, indicating a statistically significant beneficial effect ( $p = 0.004$ ).

**Table 4: Proportion of patients with relieved symptoms by 20-20-20 Rule**

Symptom Relief	No.of subjects	p-value
Yes	105	0.004
No	75	

Table 5 shows that viewing the screen from an appropriate distance contributed to symptom relief in 140 participants compared with 40 who

did not experience relief, demonstrating a highly significant association ( $p = 0.001$ ).

**Table 5: Relief of symptoms for patients who watched screen from distance**

Viewing at a distance helped to relieve symptoms?	No.of subjects	p-value
Yes	140	0.001
No	40	

Table 6 shows that the intervention was effective in alleviating multiple symptoms, including headache in 87 participants ( $p < 0.01$ ), tired eyes in 80 participants ( $p = 0.002$ ), irritation in 63 participants ( $p < 0.01$ ), burning sensation in 60

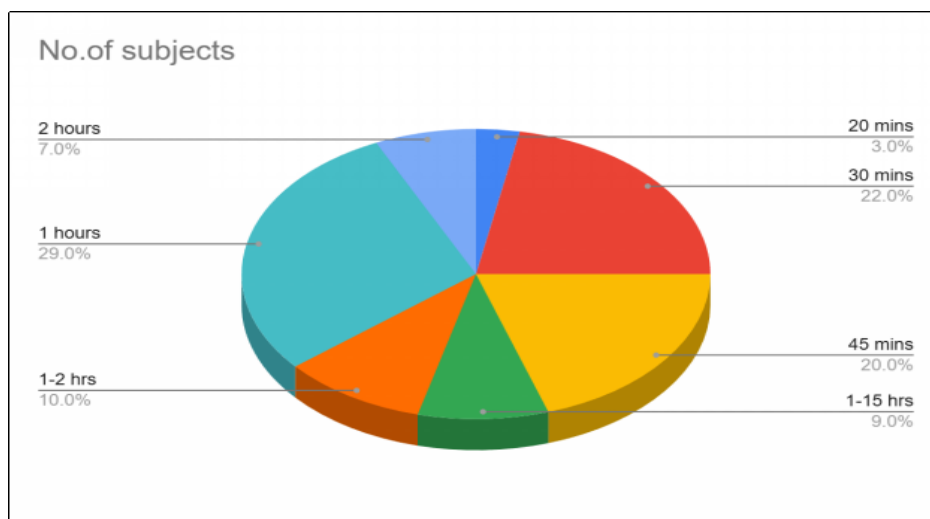
participants ( $p < 0.01$ ), and dry eyes in 50 participants ( $p = 0.018$ ), while 30 participants reported no relief, which was also statistically significant ( $p < 0.01$ ).

**Table 6: Intervention effective in alleviating certain symptoms.**

It helped you in relieving which symptom?	No.of subjects	p-value
Irritation	63	<0.01
Tired eyes	80	0.002
Burning sensation in the eyes	60	<0.01
Dry eyes	50	0.018
No relief	30	<0.01
Headache	87	<0.01

Figure 2 shows the length of the breaks when the participants used the digital devices. A break length of 1 hour was the most frequently reported length at 29 percent, and the break length of 30 minutes at 22 percent and 45 minutes at 20 percent came in second and third,

respectively. The 3 percent reported shorter 20-minute breaks, with 9 percent reporting breaks of 1-15 minutes. Breaks were less common, with 10 percent of the participants having 1 to 2 hours breaks and 7 percent of the participants having 2 hours breaks.



**Figure 2: Duration of break reported by participants**

## Discussion

Digital eye strain is a relatively new emerging public health problem, which refers to visual disturbance and /or ocular distress connected with digital device use and caused by a variety of ocular stresses in the environment. Digital eye strain symptoms are reported by up to 90 per cent of users of digital devices. According to many studies, the following factors are related to digital eye strain: uncorrected refractive error (including presbyopia), anomalies of accommodation and vergence, and altered blinking pattern (reduced and incomplete), overexposure to bright light, smaller working distance, and smaller font size. A holistic approach is necessary because a symptom can be occasioned by one or more factors. The management strategies have been proposed as follows: (i) corrective refractive error should be done, including astigmatism and presbyopia; (ii) correction of vergence anomalies, with a purpose to induce or leave small amount of heterophoria; (iii) blinking exercises/training to ensure normal blinking pattern; (iv) contact lenses with higher comfort, especially at end-of-day or in demanding work-places; (v) colour filter should be prescribed in all the options of vision correction, and most importantly blue light-absorbing [8].

A study was conducted to examine how blinking affects the tear film parameters and the ocular surface features, and the symptoms of dry eye. The rate of blinking was determined, and the presence of dry eye symptoms, tear film parameters, and surface features of the eye were measured in one clinical session. The incomplete blinking was linked to the risk of developing dry eye disease twice. The higher degrees of meibomian gland dropout, worse expressed quality of meibum, and lipid layer thickness of the tear film that is observed would indicate that incomplete blinking would predispose the development of evaporative dry eye [9].

A study was conducted to test the capacity of the 20-20-20 rule in reducing the symptoms of digital eye strain (DES) in people with long-term screen time. The participants were asked to

adhere to the 20-20-20 rule, which implies a 20-second rest after every 20 minutes to pay attention to the object that is at least 20 feet distant. The study stated that the 20-20-20 rule is an easy and efficient method of minimizing the symptoms of digital eye strain. Nonetheless, the results are different based on compliance and personal aspects. The integration of extra preventive controls and the long-term plans can further make the eyes more comfortable and healthier in the digital world [10].

A study was conducted to assess the accommodative processes just before and after performing visual fatigue-causing tasks using either a congruent (C) or a noncongruent (NC) visual stimulus. WAM-5500 open-field autorefractor was accommodative dynamics evaluated to either a 2-diopter (D) step (2.5 ↔ 4.5 D) stimulus in 10 healthy-looking, asymptomatic young-adult participants before and after C and NC tasks done in a counterbalanced fashion. In the C task, the subjects changed binocular fixation (50 cycles) between reduced Snellen charts at 50 and 20 cm after every 3 seconds in accordance with the beats of a metronome. In the case of the NC task, the subjects would complete 50 rounds of accommodative flipper (+ 1.5 D) in the shortest time possible when they were fixating on a smaller Snellen chart at a distance of 40 cm with a binocular. There was consistent fatigue effects of the accommodative system as compared to the SS variability and response accuracy [11].

Computer Vision Syndrome is declared the leading occupational hazard of the 21st century. It has emerged as a major social health concern. Adequate information on Computer Vision Syndrome and its precautions would aid in lowering the rate of the condition in a group of participants. A study was carried out on the validity of the selected nursing interventions on knowledge pertaining to Computer Vision Syndrome and asthenopia among IT professionals. The researchers established that the structured education programs resulted in a substantial reduction in the occurrence of asthenopia (eye strain) and the level of knowledge of computer vision syndrome [12].

## Conclusion

The study has concluded that adherence to the 20-20-20 rule is significantly associated with reduction in key symptoms of digital eye strain, particularly dry eyes, headache, ocular irritation, and visual fatigue, among adults with prolonged screen exposure. These findings support the clinical effectiveness of simple behavioral interventions, including periodic breaks and appropriate viewing distance, in mitigating screen-related ocular morbidity.

This prospective observational research indicates that digital eye strain is very common among adults who have long-term screen time, and other symptoms that are commonly reported include headache, fatigued eyes, irritation, burning eyes, and dry eyes. The results show that most of the participants knew the need to take breaks whenever using screens, and a substantial number of them exercised the behavior of taking a break. Notably, the 20-20-20 rule was discovered to be effective in alleviating the digital eye strain symptoms, and statistically significant improvement was found in a variety of ocular and visual symptoms. The perception of distant vision during breaks was also an additional step in alleviating the symptoms, and the concept of simple visual ergonomics in alleviating the screen-related pain. The study indicates that the 20-20-20 rule is an easy, convenient, inexpensive method to eliminate digital eye strain.

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