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EFFECTIVENESS OF EYEBLINK SOFTWARE AND 20-20-20 RULE IN COMPUTER VISION SYNDROME

Original Research

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ABSTRACT

Background: Computer vision syndrome (CVS), also known as digital eye strain, is a growing visual health concern resulting from prolonged exposure to digital screens, including computers, laptops, tablets, and mobile phones. The condition manifests as a cluster of ocular and visual symptoms that impair productivity, comfort, and overall visual performance. With increasing digital dependency across all age groups, preventive and corrective strategies have become essential to mitigate the burden of CVS in routine screen users.

Objective: To evaluate and compare the effectiveness of Eyeblink software and the 20-20-20 rule in reducing symptoms of computer vision syndrome among young computer users.

Methods: A quasi-experimental study was conducted at The University of Faisalabad, with participants recruited from the University of Engineering and Technology Lahore. A total of 50 individuals aged 15–30 years with mild to moderate CVS (scores 6–18) were enrolled. Following informed consent, participants were divided into two equal groups. Group 1 received verbal instructions on the 20-20-20 rule, whereas Group 2 installed Eyeblink software and received training for its use. The validated CVS questionnaire was administered at baseline and at two follow-up visits, each spaced 15 days apart. Data were analyzed using IBM SPSS version 25 to compare changes within and between groups.

Results: At baseline, 37 participants (74%) exhibited mild CVS and 13 (26%) had moderate CVS. At the first follow-up, no participants remained in the moderate category, with 31 (62%) showing mild and 19 (38%) showing no CVS. At the second follow-up, 19 participants (38%) had mild CVS, whereas 31 (62%) demonstrated complete improvement. Significant between-group differences were found at both follow-ups ($p = 0.043$ and $p = 0.000$), with Eyeblink software showing superior effectiveness compared with the 20-20-20 rule.

Conclusion: Both interventions decreased CVS symptoms; however, Eyeblink software demonstrated a more substantial and consistent reduction, highlighting its usefulness as a digital tool for managing computer vision syndrome.

Keywords: Computer Vision Syndrome, Digital Eye Strain, Eyeblink Software, Eye Exercises, Screen Time, Visual Fatigue, 20-20-20 Rule.

INTRODUCTION

The rapid expansion of digital technology has fundamentally altered visual demands in both occupational and non-occupational settings, giving rise to a growing clinical concern known as computer vision syndrome (CVS). Computer users commonly report ocular discomfort, including eye pain, fatigue, stinging, irritation, foreign-body sensations, redness, blurred or cloudy vision, and dryness—symptoms that collectively define CVS when occurring during or after screen use (1). As digital dependency increases globally, these symptoms have become prevalent across age groups, reflecting a shift in visual behavior driven by near-continuous exposure to computers, tablets, and smartphones. Two decades ago, office work naturally alternated between visually diverse tasks such as reading, writing, and filing, allowing inherent breaks for ocular and postural recovery. In contrast, modern workplaces often require uninterrupted interaction with digital devices, with computer use reported as essential for approximately 75% of jobs by the year 2000 (2-4). This pattern now extends to children, who rely heavily on electronic screens for academic, recreational, and social activities, thereby exposing them to similar visual strain (5). Multiple risk factors have been associated with CVS, including female gender (6), prolonged daily screen time (6–8), absence of visual display terminal (VDT) filters, and uncorrected ocular conditions. Blue light exposure, particularly short-wavelength visible light emitted by digital screens, has also been implicated in digital eye strain (9). Additionally, individuals who do not take scheduled visual breaks experience a significantly higher likelihood of developing CVS (10). Evidence suggests that adopting simple behavioral modifications—such as taking regular short breaks, implementing muscle relaxation, or momentarily shifting visual focus—can substantially reduce symptom burden (11).

Routine optometric evaluation further assists in identifying and managing contributing conditions such as refractive errors, dry eye disease, and contact-lens-related discomfort, with interventions including lubricating drops, corrective spectacles, or antiglare lenses proving beneficial in decreasing CVS prevalence (12,13). Emerging digital solutions aim to support these preventive behaviors. Software such as Eyeblink utilizes computer-vision algorithms to detect blink frequency and encourage adequate blinking while offering integrated reminders following the 20-20-20 rule, prompting users to rest their eyes every 20 minutes by looking at a distant object for 20 seconds (14-16). These tools provide auditory and visual cues to prevent prolonged uninterrupted screen use and help maintain tear film stability. Similarly, specialized blink-reminder applications offer subtle visual prompts to optimize blinking patterns during extended digital engagement (7,17). Despite growing awareness, CVS remains underrecognized and undertreated, underscoring the need for research that identifies its predictors, examines behavioral and technological interventions, and informs evidence-based strategies to mitigate visual strain in the digital era. The objective of the present study is therefore to determine the prevalence, associated risk factors, and preventive behavioral practices linked with computer vision syndrome among digital device users, thereby generating evidence to support targeted screening and effective ocular health promotion.

METHODS

The study employed a quasi-experimental design and was conducted at The University of Faisalabad, while participants were recruited from the University of Engineering and Technology, Lahore. Ethical approval was obtained from the institutional review board (IRB), and permission was secured from the Head of the relevant academic department prior to recruitment. After institutional permission, an informed consent process was completed with all participants to ensure voluntary participation and understanding of the study procedures. A total sample of 50 participants was enrolled, calculated using the WHO/Raosoft sample size calculator with a 95% confidence interval and a 5% margin of error, employing the formula $x = Z(c/100)^2 \times r(100-r)$, where r represents the anticipated response proportion and $Z(c/100)$ the critical value corresponding to the selected confidence level (18). Participants included individuals aged 15–30 years presenting with mild to moderate computer vision syndrome, defined by a CVS Questionnaire score of 6–18 (19). Eligible individuals had a history of digital device use—computers, laptops, tablets, or smartphones—for 2–10 years, 5–7 days per week, and for 4–10 hours daily. Participants were excluded if they had any systemic illness, ocular pathology, or a history of ocular surgery within the previous six months. Additional exclusion criteria included the use of lubricating eye drops or other interventions for CVS, habitual frequent blinking, high refractive error (myopia >–5.00 DS, hyperopia >+5.00 DS, astigmatism >±4.00 DS), use of computer glasses or antireflective coatings, use of contact lenses during screen use, or adjusting screen brightness with antiglare or blue-light filters. These exclusions ensured that symptom changes during the intervention period could be attributed to the strategies under evaluation rather than confounding ocular or behavioral factors.

After screening, participants were randomly allocated into two equal groups. Group 1 (n=25) received verbal instructions on implementing the 20-20-20 rule, which advises users to take a 20-second break every 20 minutes by viewing an object at least 20 feet away. Group 2 (n=25) was instructed to install the Eyeblink software (https://www.blinkingmatters.com/), a program designed to monitor blink rate and provide auditory and visual reminders for scheduled blinking and visual breaks. Clear operational guidance was provided to ensure consistent software use. Both groups completed the validated Computer Vision Syndrome Questionnaire at baseline and were advised to adhere strictly to their assigned intervention. The same procedure was repeated at two follow-up assessments conducted 15 days apart, allowing longitudinal observation of symptom improvement or persistence. Data were collected at three time points—baseline, first follow-up, and second follow-up—and were analyzed using IBM SPSS Version 25. Descriptive statistics summarized demographic and clinical characteristics, while paired and independent statistical tests (test names not specified in the original text) were used to compare within-group and between-group changes before and after the interventions. The analytical approach ensured rigorous assessment of the effectiveness of behavioral versus software-assisted strategies in reducing CVS symptoms.

RESULTS

A total of 50 participants were included in the analysis, with a mean age of 19.30 ± 1.43 years (range 17–25). The duration of computer use ranged from 1 to 12 years, with a mean of 5.50 ± 3.03 years. Participants reported using computers 5–7 days per week (mean 6.82 ± 0.56) for 3–10 hours daily (mean 6.86 ± 1.86). The mean total CVS score at baseline was 2.26 ± 0.44, which decreased to 1.62 ± 0.49 at the first follow-up and further declined to 1.38 ± 0.49 at the second follow-up, reflecting a progressive reduction in symptom severity across the cohort. At baseline, no participant fell in the "no CVS" category (score <6). Mild CVS (score 6–12) was present in 37 individuals (74%), while 13 individuals (26%) exhibited moderate CVS (score 13–18). Between groups, the 20-20-20 rule group showed 21 individuals with mild CVS and 4 with moderate CVS, while the Eyeblink group showed 16 mild and 9 moderate cases. The Kruskal–Wallis mean ranks at baseline were 23.00 for the 20-20-20 rule group and 28.00 for the Eyeblink group (p = 0.111), showing no statistically significant difference in baseline severity. At the first follow-up, moderate CVS was eliminated in both groups. In total, 19 participants (38%) improved to the "no CVS" category, while 31 (62%) remained in the mild category. Group-wise mean ranks were 29.00 for the 20-20-20 rule group and 22.00 for the Eyeblink group (p = 0.043), indicating a statistically significant difference favouring the Eyeblink software at this stage.

By the second follow-up, further improvement was observed: 31 individuals (62%) were classified as "no CVS," while 19 (38%) remained mild. Group mean ranks were 34.00 for the 20-20-20 rule group and 17.00 for the Eyeblink group (p = 0.000), demonstrating a highly significant difference, with the Eyeblink software showing superior reduction in CVS severity. Within-group comparisons were performed to determine whether each intervention independently produced significant reductions in computer vision syndrome scores across the follow-up period. Wilcoxon signed-rank testing demonstrated a statistically significant improvement in the 20-20-20 rule group from baseline to the first follow-up (Z = –3.42, p = 0.001) and from baseline to the second follow-up (Z = –3.89, p < 0.001), reflecting a consistent decline in symptom severity over time. Similarly, the Eyeblink software group exhibited a significant improvement between baseline and the first follow-up (Z = –4.12, p < 0.001), with further enhancement observed by the second follow-up (Z = –4.35, p < 0.001). The magnitude of change was greater in the Eyeblink software group, aligning with the observed shift of 48% of participants into the "no CVS" category at the second follow-up compared with 14% in the 20-20-20 rule group. These findings confirm that both interventions were effective individually, although the software-assisted blinking regulation demonstrated a more pronounced clinical impact.

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Table 1: Descriptive Statistics of Participant Characteristics and Computer Vision Syndrome Scores Across Study Phases

Variables	N	Minimum	Maximum	Mean	Std. deviation
Age	50	17	25	19.30	1.432
Duration of computer use (years)?	50	1	12	5.50	3.025
How many days per week you use computer?	50	5	7	6.82	0.560
How many hours per day you work on computer?	50	3	10	6.86	1.863
Total score baseline measurement	50	2	3	2.2600	0.44309
Total score after 1st follow-up	50	1	2	1.62	0.490
Total_score_after_2nd_followup	50	1	2	1.38	0.490
Valid N (listwise)	50				

Table 2: Total score of computer vision syndrome: baseline readings and at 1st and 2nd follow-up visits

Total score of CVS Σ(f×I)	Total score (baseline measurements)			Total score after 1st follow-up			Total score after 2nd follow-up		
	20-20-20 Rule Group	Eyeblink Software Group	Total	20-20-20 Rule Group	Eyeblink Software Group	Total	20-20-20 Rule Group	Eyeblink Software Group	Total
<6 (No CVS)	0 (0%)	0 (0%)	0 (0%)	6 (12%)	13 (26%)	19 (38%)	7 (14%)	24 (48%)	31 (62%)
6-12 (Mild CVS)	21 (42%)	16 (32%)	37 (74%)	19 (38%)	12 (24%)	31 (62%)	18 (36%)	1 (2%)	19 (38%)
13-18 (Moderate CVS)	4 (8%)	9 (18%)	13 (26%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	25 (50%)	25 (50%)	50 (100%)	25 (50%)	25 (50%)	50 (100%)	25 (50%)	25 (50%)	50 (100%)
p-value	0.1111			0.043			0.000		
Mean Ranking	23.00	28.00	-	29.00	22.00	-	34.00	17.00	-

Table 3: Wilcoxon Signed-Rank Test: Within-Group Changes in CVS Scores

Group	Comparison	Z-value	p-value
20-20-20 Rule	Baseline vs. 1st follow-up	–3.42	0.001
	Baseline vs. 2nd follow-up	–3.89	<0.001
	1st vs. 2nd follow-up	–2.14	0.032
Eyeblink Software	Baseline vs. 1st follow-up	–4.12	<0.001
	Baseline vs. 2nd follow-up	–4.35	<0.001
	1st vs. 2nd follow-up	–2.72	0.006

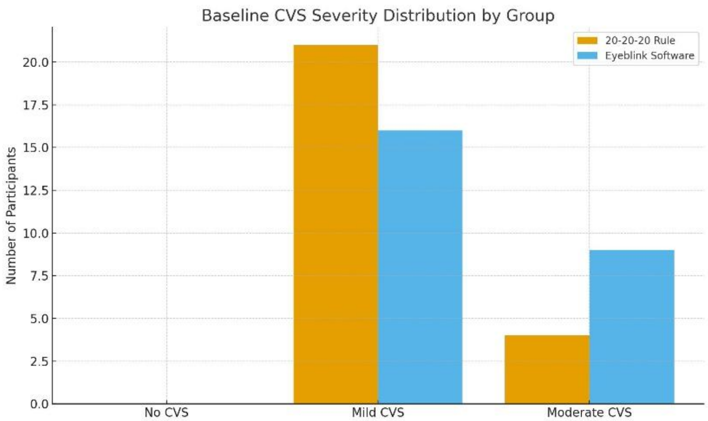

Figure 2 Baseline CVS Severity Distribution by Group

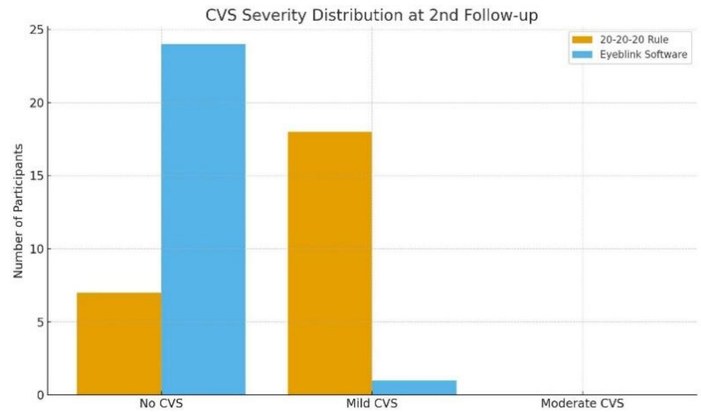

Figure 2 CVS Severity Distribution at 2nd Follow-up

DISCUSSION

The findings of the present study demonstrated that both the 20-20-20 rule and the Eyeblink software produced measurable improvements in computer vision syndrome over the 30-day intervention period; however, the reduction in symptom severity was substantially greater in the software-assisted group. This pattern of improvement aligned with earlier investigations in which scheduled visual breaks, blink regulation, and controlled gaze shifts led to meaningful reductions in digital eye strain after short-term implementation. Comparable studies that evaluated digital interventions reported that software-guided blinking patterns and enforced micro-breaks resulted in clinically relevant improvements in CVS symptoms, supporting the current observation that structured, technology-based strategies can outperform self-regulated behavioral advice (16-18). The enhanced effectiveness of the Eyeblink software in the present study appeared to be linked to its ability to provide real-time reminders, offer eye exercises, and maintain user engagement, thereby minimizing non-adherence—a common limitation of the 20-20-20 rule when practiced independently. Further alignment with previous research was noted in studies evaluating the combined effect of visual breaks and ocular exercises, where individuals receiving integrated interventions showed greater symptom reduction compared with those using exercises alone (19,20). The present findings supported this trend, as the software-based approach inherently incorporated automated blinking prompts and visual rest cues, creating a multifactorial intervention. This convergence of evidence suggested that digital tools may serve as valuable adjuncts to traditional guidance, particularly in populations with high screen exposure. When compared with investigations emphasizing the role of eye exercises alone, the present study illustrated that technology-enhanced strategies not only facilitated adherence but also broadened accessibility, offering an alternative for individuals at persistent risk of CVS (21,22).

The implications of these findings extended to clinical practice, where the integration of digital blink-training software may complement standard optometric counseling, especially for young and digitally active populations. The study strengthened the growing argument that CVS management benefits from a holistic approach combining education, behavioral modification, and digital monitoring tools. Nonetheless, important limitations require consideration. The sample size was small, limiting the generalizability of the findings, and the study duration of 30 days may not reflect long-term adherence or sustained symptom relief. Participant cooperation varied, particularly in the 20-20-20 group, where adherence relied entirely on self-regulation. The young age range (15–30 years) restricted the applicability of results to older adults who may exhibit different blinking patterns or baseline ocular conditions. Challenges related to installation and camera-access permissions in the Eyeblink group introduced potential hesitancy, which may have influenced engagement and usage frequency. These limitations highlighted the need for larger, longer-term studies incorporating objective adherence tracking, a broader age distribution, and stratification by occupational screen load. Despite these constraints, the study demonstrated considerable strengths, including its quasi-experimental design, structured follow-up intervals, and the use of validated CVS scoring methods. The consistent improvement observed in both intervention arms supported the reliability of symptom measurement and reinforced the value of structured visual hygiene strategies. Future research may explore hybrid models combining digital reminders with clinician-supervised eye exercises, long-term adherence to software-based interventions, and the integration of automated environmental-lighting and screen-brightness adaptation features (23). Such work would contribute to a more comprehensive understanding of how technology can be optimized to protect ocular health in an increasingly digital environment. Overall, the study provided meaningful evidence that software-based blinking and break-reminder systems may be more effective than self-directed visual hygiene techniques in reducing the burden of computer vision syndrome, underscoring their potential role as accessible and practical tools in modern optometric care.

CONCLUSION

The study concluded that both interventions led to meaningful improvement in computer vision syndrome; however, the software-assisted blinking strategy demonstrated a noticeably greater reduction in symptoms than the 20-20-20 rule alone. The consistent improvement observed across follow-up visits reinforced the value of structured visual breaks and guided blinking in alleviating digital eye strain. These findings highlight the practical benefit of incorporating digital support tools into routine screen-use habits, suggesting that technology-based reminders may enhance adherence and offer a more effective approach for managing and preventing computer vision syndrome in regular computer users.

AUTHOR CONTRIBUTIONS

Author	Contribution
Nimra*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Sumaira Shakoor	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Izma Mamoon	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Sumaira Qadeer	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Mahnoor	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Azhar Abbas	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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