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REINFORCING 20-20-20 RULE IN VIDEO DISPLAY TERMINAL USERS: A PROOF OF CONCEPT!

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INTRODUCTION

Primitively, mankind was more involved in typing, filing, reading, and writing. When computers came into the picture, this range of activities evolved and has made a great difference. After introducing the computers, the tasks that were being performed on the desktop did not involve any movement. Additionally, it improved the quality, production, and efficiency[1]. Not only is the number of users growing, but so is the amount of time spent on the gadget. Despite their positive effects, computers and gadgets have negative consequences, one of which is emission of high energy visible light (blue light). Blue light emitted by gadgets is harmful to the eyes when used for extended periods of time[1].

Between 2021-2022, the number of internet users in India increased by 34 million (+5.4%). The statistics showed the computer usage to be 84.5% for the duration of 6hrs/day and 33.8% for 2-3hrs/day[2].

The prolonged use of digital devices is leading to digital eye disease (DED), which is being characterized by several ocular and visual symptoms. The typical symptoms that have been observed over the days are eyestrain, headache, dry eyes, stinging, and redness. There was an increase in musculoskeletal disorders (MSD) that were directly associated with the computer use[3]. 90.2% of video display terminal (VDT) workers self-reported MSDs, with shoulder pain accounting for 57.0% and neck pain accounting for 38.3%. The chair complaint rate was found to be 33.4%2. DED reduces productivity, raises healthcare costs, and even lowers users' quality of life[4].

There are around 145 million contact lens (CL) wearers worldwide, most of whom are soft CL wearers. In order to increase friction between the contact lens and the ocular surface, a contact lens separates the tear film into pre-lens and post-lens tear films. It is estimated that 30-50% of contact lens

wearers experience dry eye symptoms[5]. DED symptoms and indicators originate from defective tear film and impaired protective effects in DED patients. DED is divided into two categories: aqueous deficiency dry eyes (ADDE) and evaporative dry eyes (EDE). Whereas EDE is recognized by extensive evaporation from the corneal surface, ADDE is identified by the lack of the aqueous component of the tear film. A variant of EDE known as short break up time dry eye (SBUTDE) is characterized by complaints and an instability of tear film as determined by a decreased TBUT. It has been observed to occur frequently in office workers. The use of visual display terminals (VDT) for a prolonged period has been linked to an increased risk of EDE. Use of a VDT regularly lowers blink rates and raises the percentage of incomplete blinks, increasing ocular surface exposure to the environment and causing excessive tear fluid to evaporate. The resulting tear fluid loss can result in hyperosmolarity, ocular surface degradation, unstable tears, and symptoms of dry eyes [4].

Although there is no clarity regarding the best way to manage CVS, a few ideas have been widely embraced. The American Optometric Association offered a couple of suggestions for treating DES-related symptoms, including (1) adhering to the 20-20-20 rule, which calls for 20 seconds of eye rest every 20 minutes while seeing a target 20 feet away. (2) appropriate use of lenses to meet visual demands (3) proper positioning of the body while working on computers[3,6,7]. Other management strategies include work station and lighting adjustments, antiglare filters, and taking regular work breaks. The renowned 20-20-20 rule was proposed by Dr. Jeff Anshell, which helped people relieve DES related symptoms and provided them with comfort.

MATERIALS AND METHODOLOGY

An experimental intervention research was carried out in a tertiary eye hospital for period of 5 months from October 2022 to February 2023. The research enrolled 90 dry eye participants through Convenience sampling.

Healthy individuals aged between 21-35 years having visual acuity of 0.5-0.0 log MAR unit or better, with or without refractive error and working on computer for 5-8 hours per day were included. The study also comprised subjects wearing Contact Lens or Spectacles with refractive error not exceeding $\pm$ 3.00Ds with $\pm$ 2.50Dc.

Subject diagnosed with systemic and ocular health diseases such as scleritis, uveitis, glaucoma, conjunctivitis, and keratitis or the individuals undergone ocular surgery such as LASIK, RK, cataract surgery, squint correction surgery and retinal detachment surgery were excluded. Active smokers, Pregnant ladies and females using contraceptive pills were omitted from study.

Methodology for data collection:

The Ethics Committee of the hospital approved this study, which was carried out in accordance with the Declaration of Helsinki criteria.

All the participants were educated about the research study through educational intervention and signed consent was acquired from each participant.

Baseline visit (visit 1)

Prior to the evaluation, a thorough medical history was taken from each of the participants of either gender. Each participant was questioned to understand more about their work environment and to find out if they were suffering any symptoms of dry eye. Visual acuity with logMAR chart, objective refraction with retinoscopy, subjective refraction and slit lamp examinations were performed to evaluate anterior segment to identify those participants who meet the study criteria. Subsequently, three visits were made by participants.

Clinical evaluation of dry eye disease:

Emmetropes and subjects wearing Contact lenses and spectacles while working on computer for 5-7hrs/day were evaluated for tear film stability using Tear Break Up Test (TBUT). Sodium fluorescein was instilled into the eyes, and tear film was assessed under Cobalt blue filter light. The time taken for the tear film to break up following blink cessation and first occurrence of dry spot, which appears as a black area in the tear film, was recorded. Care was taken not to touch or disturb the lids and to maintain the normal position of the lids. Demographic data, including their name, age, gender, occupation, and address were recorded using proforma. On average, three readings were taken from the participants to minimize the error.

Figure 1: Measuring TBUT of patient at day 1

Intervention:

The participants selected for the research were educated about the 20-20-20 rule and were advised to drink 3-4 liters of water/day. In between tasks, they were advised to perform a few exercises while seated on the chair.

Follow-up visit (visit 2 and 3):

The effect of educational intervention through 20-20-20 rule was examined at the follow-up visits held thirty-two (visit 2) and sixty-two (visit 3) days after the baseline visit for all participants. All the procedures described above were repeated at the follow up visits to evaluate tear film and ocular surface. There were no anticipated risk factors.

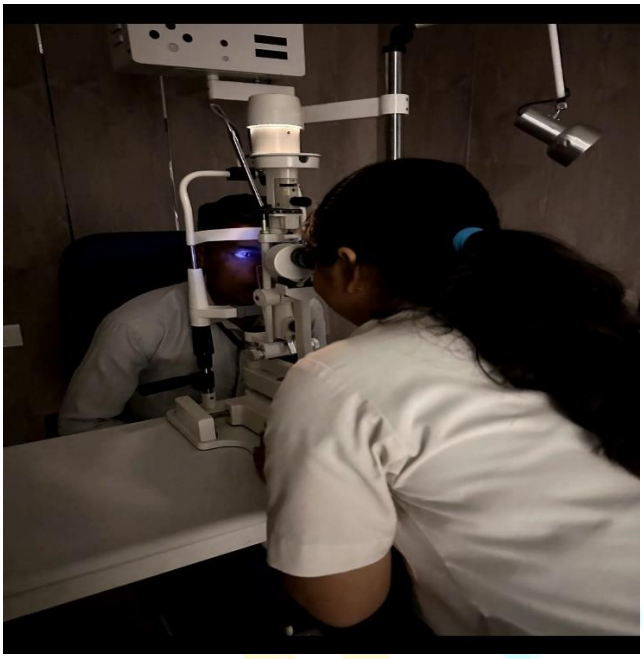

Figure 2: Measuring TBUT of subject at follow up visit

Data was entered in Microsoft Excel 2019 (Part of Microsoft Office Professional Edition) [computer program]. Microsoft; 2019) and analyzed using MedCalc v18.2.1 (MedCalc Statistical Software version 18.2.1 (MedCalc Software, Ostend, Belgium; http://www.medcalc.org; 2018).

Categorical variables were summarized using number (N) & percentages (%) and 95% confidence limits (where applicable), continuous variables expressed as mean and SD & Median and IQR (where applicable). Normal distribution was verified by Shapiro-Wilk test. Friedman test was used to check for significance of observations within the groups over time. Kruskal-Wallis test was used to check for significance of observations between multiple groups. In all the tests performed, $P < .05$ was statistically significant.

RESULT

The study included 90 participants (180 eyes), 48 females (53.3%) and 42 male (46.7%) (table 1). They varied in age from 21 to 34, with a mean age of 27.3 years, a standard deviation of 3.3, and a 95% confidence interval of 26.6 to 28.04.

Gender	Frequency	Percentage
Female	48	53.3
Male	42	46.7
Total	90	100%

Table 1: Distribution of sample according to gender

Type of wearer	Frequency	Percentage
Contact lens	42	46.7%
None	10	11.1%
Spectacle	38	42.2%
Total	90	100%

Table 2: Showing type of wearers of refractive correction

Type of wearer	Day	Mean (SD)	95% CI	Median (IQR)	Minimum	Maximum	Sig. *'P'**
Contact lens	1	13.62 (0.79)	13.37 to 13.87	14.00 (13 to 14)	12.00	15.00	X^2 (2)= 84 P < .0001
	32	16.98 (0.90)	16.70 to 17.26	17.00 (16 to 17)	15.00	19.00	
	62	22.10 (0.98)	21.79 to 22.40	22.00 (21 to 23)	20.00	24.00	
Spectacle	1	15.45 (0.92)	15.15 to 15.75	15.00 (15 to 16)	14.00	17.00	X^2 (2)= 76 P < .0001
	32	18.26 (1.22)	17.86 to 18.67	18.00 (17 to 19)	16.00	20.00	
	62	23.37 (1.15)	22.99 to 23.75	23.50 (23 to 24)	21.00	25.00	
None	1	15.10 (0.57)	14.69 to 15.51	15.00 (15 to 15)	14.00	16.00	X^2 (2)= 20 P < .0001
	32**	18.60 (0.84)	17.99 to 19.20	19.00 (18 to 19)	17.00	20.00	
	62**	24.10 (1.20)	23.24 to 24.96	24.00 (23 to 25)	22.00	26.00	
Total	1	14.56 (1.21)	14.30 to 14.81	14.50 (14 to 15)	12.00	17.00	X^2 (2)= 180 P < .0001
	32	17.70 (1.24)	17.44 to 17.96	17.50 (17 to 19)	15.00	20.00	
	62	22.86 (1.30)	22.58 to 23.13	23.00 (22 to 24)	20.00	26.00	

** Normally distributed *Friedman test

Table 3: Showing descriptive analysis for right eye

Type of wearer	Day	Mean (SD)	95% CI	Median (IQR)	Minimum	Maximum	Sig. '*P*'*
Contact lens	1	13.95 (0.66)	13.75 to 14.16	14.00 (14 to 14)	13.00	15.00	X^2 (2)= 84 *P* < .0001
	32	17.14 (0.95)	16.85 to 17.44	17.00 (16 to 18)	16.00	20.00	
	62	22.33 (0.98)	22.03 to 22.64	22.00 (22 to 23)	21.00	24.00	
Spectacle	1	15.00 (0.77)	14.75 to 15.25	15.00 (15 to 15)	13.00	17.00	X^2 (2)= 76 *P* < .0001
	32	18.03 (1.00)	17.69 to 18.36	18.00 (17 to 19)	17.00	21.00	
	62	23.34 (0.88)	23.05 to 23.63	23.00 (23 to 24)	21.00	25.00	
None	1	15.10 (0.88)	14.47 to 15.73	15.00 (14 to 16)	14.00	16.00	X^2 (2)= 20 *P* < .0001
	32**	19.00 (1.05)	18.25 to 19.75	19.00 (18 to 20)	18.00	21.00	
	62	24.20 (0.79)	23.64 to 24.76	24.00 (24 to 25)	23.00	25.00	
Total	1	14.52 (0.90)	14.33 to 14.71	14.50 (14 to 15)	13.00	17.00	X^2 (2)= 180 *P* < .0001
	32	17.72 (1.15)	17.48 to 17.96	18.00 (17 to 18)	16.00	21.00	
	62	22.97 (1.12)	22.73 to 23.20	23.00 (22 to 24)	21.00	25.00	

** Normally distributed *Friedman test

Table 4: Showing descriptive analysis for left eye

Type of wearer	Difference	Mean (SD)	95% CI	Median (IQR)	Minimum	Maximum	Sig. 'p'#
Contact lens	**Day 32-1**	3.36 (0.98)	3.05 to 3.66	3.00 (3 to 4)	2.00	6.00	H(2)=9.19
Spectacle	**Day 32-1**	2.82 (0.73)	2.58 to 3.06	3.00 (2 to 3)	1.00	4.00	*P* = .01
None	**Day 32-1**	3.50 (0.53)	3.12 to 3.88	3.50 (3 to 4)	3.00	4.00	
Contact lens	**Day 62-1**	8.48 (1.09)	8.14 to 8.82	8.50 (8 to 9)	6.00	10.00	
Spectacle	**Day 62-1**	7.92 (0.94)	7.61 to 8.23	8.00 (7 to 9)	6.00	10.00	H(2)=10.1
None	**Day 62-1 ****	9.00 (1.05)	8.25 to 9.75	9.00 (8 to 10)	7.00	10.00	*P* = .01
Contact lens	**Day 62-32**	5.12 (0.92)	4.83 to 5.41	5.00 (5 to 6)	3.00	8.00	H(2)=1.51
Spectacle	**Day 62-32**	5.11 (1.16)	4.73 to 5.49	5.00 (4 to 6)	3.00	7.00	*P* = .47
None	**Day 62-32****	5.50 (0.97)	4.81 to 6.20	6.00 (5 to 6)	4.00	7.00	

** Normally distributed # Kruskal Wallis Test

Table 5: Showing difference between type of wearers and three different visits for right eye

Kruskal Wallis Test was done for seeing the difference within the groups on second visit (day 32-1), third visit (day 62-1) and was found to be statistically significant for a user with CL, spectacles and subjects not wearing any refractive correction with a ***P*** value of .01 (table 5)

For third visit (day 62-32) the Kruskal Wallis Test performed to analyze the difference within the groups was not statistically significant (***P*** = .47). (table 5)

Factor	N	Average rank	Different (P<0.05) from factor nr
(1) CONTACT LENS	42	50.51	(3)
(2) NONE	10	57.75	(3)
(3) SPECTACLE	38	36.74	(1)(2)

Table 6: Showing Post-hoc analysis for Day 1-32

Post Hoc analysis shows that the improvement was significantly less in spectacle group compared to contact lens and group with normal vision (table 6).

Factor	N	Average rank	Different (P<0.05) from factor nr
(1) CONTACT LENS	42	49.80	(3)
(2) NONE	10	61.55	(3)
(3) SPECTACLE	38	36.53	(1)(2)

Table 7: Showing Post-hoc analysis for Day 1-62

Post Hoc analysis shows that the improvement was significantly less in spectacle group compared to contact lens and group with normal vision. (table 7)

Type of wearer	Difference	Mean (SD)	95% CI	Median (IQR)	Minimum	Maximum	Sig. '*P*'#
Contact lens	**Day 32-1**	3.19 (0.86)	2.92 to 3.46	3.00 (3 to 4)	1.00	5.00	H(2)=3.88 *P*= .14
Spectacle	**Day 32-1**	3.03 (0.91)	2.73 to 3.33	3.00 (2 to 4)	1.00	6.00	
None	**Day 32-1****	3.90 (1.37)	2.92 to 4.88	3.50 (3 to 5)	2.00	6.00	
Contact lens	**Day 62-1**	8.38 (1.03)	8.06 to 8.70	8.00 (8 to 9)	7.00	11.00	H(2)=3.86 *P*= .14
Spectacle	**Day 62-1**	8.34 (0.85)	8.06 to 8.62	8.50 (8 to 9)	6.00	10.00	
None	**Day 62-1****	9.10 (1.37)	8.12 to 10.08	9.50 (8 to 10)	7.00	11.00	
Contact lens	**Day 62-32**	5.19 (0.86)	4.92 to 5.46	5.00 (5 to 6)	3.00	7.00	H(2)= .59 *P* = .75
Spectacle	**Day 62-32**	5.32 (1.04)	4.97 to 5.66	5.00 (5 to 6)	3.00	7.00	
None	**Day 62-32****	5.20 (1.03)	4.46 to 5.94	5.00 (4 to 6)	4.00	7.00	

** Normally distributed # Kruskal Wallis Test

Table 8: Showing difference between type of wearers and three different visits for right eye

A Kruskal Wallis test was done to see the difference within the groups and was found not to be significant (table 8).

DISCUSSION

This experimental study compares tear break up time between Contact lens wearer, spectacle wearer and emmetropes. The participants were summoned on three different days. In a research by Talens-Estarelles et al., dry eye symptoms and digital eye strain decreased with the 20-20-20 rule reminders (***P*** ≤ .045), yet this improvement was not sustained after termination (***P*** > .05), and no changes on the ocular surface and tear film parameters were detected with the 20-20-20 rule reminders (***P*** ≥ .089)[7] . In different research carried out in Indonesia by Anggrainy P et al., statistical analysis of the treatment group's pre and post intervention of CVS score revealed significant changes (***P*** < .05). Moreover, statistical comparisons between the treatment and control groups revealed a significant difference in CVS incidence between the two groups (***P*** < .05)[8]. According to our study, symptoms and digital eye strain were reduced among individuals who adhered to the 20-20-20 rule.

In an Indonesian study done by Zulkarnain BS et al. the before-test and after-test scores, TBUT and ODSI were measured within fourteen days. It was seen that most of the students understood 20-20-20 rule. Awareness about 20-20-20 rule increased (***P*** < .0001). Improvement was seen in TBUT (***P*** < .0001) for dry eyes.[1] In our study a significant increase in the TBUT readings was seen on day 62 (third visit) as compared to day 1 (visit 1). The mean TBUT reading on day 1 was recorded as 14.56 ± 1.21seconds and 22.86 ± 1.30 seconds on day 62 which showed a significant improvement. Statistical significance is shown by a ***P*** value of < .0001.

The goal of the current study was to determine if the 20/20/20 rule educational intervention would be successful in reducing participants' signs and symptoms related to dry eyes. The study found that the educational intervention significantly reduces the symptoms of dry eyes (***P*** < .0001). This is consistent with the American Optometric Association's suggestion stating CVS symptoms may be eliminated from everyday proximal activities by adhering to the 20/20/20 rule. Similar results were seen in study by Alrasheed SH et al. wherein TBUT showed a statistically significant rise following the educational intervention (***P*** = .005). This may be due to the frequent blinking that occurs when performing the 20/20/20 exercise, which re-wets the cornea, minimizes dryness, and lengthens the tear break up time[3].

CONCLUSION

According to our study the 20-20-20 rule's educational intervention leads to substantial improvement in tear film. This rule helped alleviate dry eye symptoms and improved participant's quality of life.

Adopting the 20-20-20 rule dramatically altered how subjects used their computers by raising the total number of breaks taken daily while decreasing the length of breaks and the time spent gazing at the computer screen without any pauses. 20-20-20 rule benefited participants in reducing their dry eye symptoms, as clinically demonstrated by an increase in TBUT readings. The participants required approximately 3-4 weeks to implement this rule in their daily lives.

The current study found that implementing reminders of the 20-20-20 rule had a substantial influence on the way subjects utilized their digital screens. When the 20-20-20 rule reminders were turned on, participants took more breaks per day overall than when they were turned off.

In order to raise awareness about, importance of routine eye exam and adherence to 20-20-20 rule it is necessary to design effective educational techniques. This will aid to lessen dry eye related complaints. It could be better to further shorten the gap between breaks or to provide customized exercises depending on computer user's habitual routine.

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