Original Article

Computer Vision Syndrome- Is It a Silent Epidemic?

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Abstract

Purpose: To estimate the prevalence of computer vision syndrome and evaluate the effects of interventions applied to computer users in a tertiary care hospital.

Materials and Methods: In our study, 102 eyes of 51 people (non-medicos) with desk job using computers/mobile were taken as the study group. The Schirmer test, tear breakup time (TBUT) and ocular surface disease index (OSDI) were evaluated. Accordingly, they were given treatment and followed up.

Results: In our study, we included 51 subjects who were a regular user of mobile and computers. Mean screen time was 6.08 ± 1.5 hours. Before treatment, the mean Schirmer's, TBUT and OSDI test were 8.85 ± 1.2 mm (range 5.5–11.5 mm), 7.64 ± 2.4 seconds (range 4.0–12.5 seconds) and 30.47 ± 13.1 (range 10.40–62.50), respectively. The prevalence of dry eye was 58%, according to OSDI severity grading. After treatment, the Schirmer1, TBUT and OSDI tests showed improvement and the results were highly significant ($p < 0.001$).

Conclusions: It is important to optimize the exposure time and improve awareness among users. Its high time now, every institution should come up with a few guidelines in concern with the high screen time of the desk job worker.

Keywords: Computer vision syndrome, Computer users, Screen time.

Introduction

The COVID-19 pandemic has led to an inevitable rise in the use of digital technologies due to social distancing norms and nationwide lockdowns.

The lockdown has resulted in most people taking to the internet and internet-based services to communicate, interact, and continue with their job responsibilities in hospitals. Online services have seen rises in usage from 40 to 100%, compared to pre-lockdown levels.[1] Video-conferencing services have seen ten times increase in usage, and content delivery services especially in the hospital setting.[2-5]

The lockdown across countries has led to a rise in the use of digital technologies, with massive changes in usage patterns and behavior. Employees are adjusting to new "normal" - with meetings going completely online, office work shifting to the home, with new coming up patterns of work.[6-9] These changes have come across many organizations in business, hospitals, or government.

Dry eye is a tear film disorder that occurs due to tear deficiency or excessive tear evaporation; it causes damage to the interpalpebral ocular surface and is linked with various symptoms reflecting ocular discomfort.[1]

Dry eye symptoms can be a manifestation of a systemic disease; therefore, timely detection can lead to the recognition of a life–threatening condition. Moreover, patients with dry eye are prone to potentially blinding infections, such as bacterial keratitis[2] and at an increased risk of complications following procedures like laser refractive surgery.

The novel coronavirus (COVID-19) has quickly spread worldwide, and the number of cases and deaths is consistently growing. Public health measures of home confinement, including smart working and the mass use of face masks, have been imposed to reduce the outbreak's size.[3]

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Ocular Surface Disease Index© (OSDI©)[2]

Ask your patients the following 12 questions, and circle the number in the box that best represents each answer. Then, fill in boxes A, B, C, D, and E according to the instructions beside each.

Have you experienced any of the following *during the last week?*	All of the time	Most of the time	Half of the time	Some of the time	None of the time
1. Eyes that are sensitive to light?	4	3	2	1	0
2. Eyes that feel gritty?	4	3	2	1	0
3. Painful or sore eyes?	4	3	2	1	0
4. Blurred vision?	4	3	2	1	0
5. Poor vision?	4	3	2	1	0

Subtotal score for answers 1 to 5 (A)

Have problems with your eyes limited you in performing any of the following *during the last week?*	All of the time	Most of the time	Half of the time	Some of the time	None of the time	N/A
6. Reading?	4	3	2	1	0	N/A
7. Driving at night?	4	3	2	1	0	N/A
8. Working with a computer or bank machine (ATM)?	4	3	2	1	0	N/A
9. Watching TV?	4	3	2	1	0	N/A

Subtotal score for answers 6 to 9 (B)

Have your eyes felt uncomfortable in any of the following situations *during the last week?*	All of the time	Most of the time	Half of the time	Some of the time	None of the time	N/A
10. Windy conditions?	4	3	2	1	0	N/A
11. Places or areas with low humidity (very dry)?	4	3	2	1	0	N/A
12. Areas that are air conditioned?	4	3	2	1	0	N/A

Subtotal score for answers 10 to 12 (C)

Add subtotals A, B, and C to obtain D (D = sum of scores for all questions answered) (D)

Total number of questions answered (do not include questions answered N/A) (E)

Please turn over the questionnaire to calculate the patient's final OSDI© score.

Figure 1: Ocular Surface Disease Index Scoring System

On the one hand, the increase in smart working exposes individuals to a higher screen time, an important risk factor for DED.[10-14] The excessive evaporation of tear fluid due to prolonged blinking intervals while looking is thought to be the main causative factor.

On the other hand, the use of face masks could represent an additional piece of the puzzle of DED in the COVID-19 era.

Assessment of symptoms is a key component of the diagnosis of clinical dry eye and may provide a more integrated view of the clinical condition over time.

As per American Optometric Association, an group of eye and vision-related problems develop with as little as 2 h/day of continuous digital device use and referred as digital eye strain.[14] A constellation of multiple ocular symptoms was evident with use of the VDU which is grouped under "computer vision syndrome",[15-18] including eyestrain, watering eyes, headache, tired eyes, burning sensation, red eyes, irritation, dry eye, foreign body sensation, blurred vision at near and double vision.[7,10,16-36] Moreover, musculoskeletal symptoms such as shoulder, neck, back, and wrist pain are also prevalent in VDU users.[10,23,37,38]

Materials and Methods

It is an interventional hospital-based study of 102 eyes of 51 people (non-medicos) with desk job using computer/ mobile. The cases were examined during 8 AM to 5 PM. It was conducted during the month of July in 2021 in the Department of Ophthalmology of a tertiary eye care center-SRMS-IMS, Bareilly, U.P, India. The research was approved by the institutional research ethics committee and was in accordance to the tenets set forth in the declaration of Helsinki.

They were examined on day 0 of their presentation to the OPD and later on after 30 days. During the study, they were asked to fill a questionnaire (OSDI) based on their symptoms.

Ocular Surface Disease Index (OSDI)

The OSDI questionnaire was used to measure DES based on three symptomatic subscales. The possible answers were: always, almost always, half the time, sometimes, and never. The scales evaluated were ocular discomfort, functionality, and environmental factors. A sum score on a 0–100 scale was obtained and classified as: normal (0–12), mild (13–22), moderate (23–32), or severe (33–100).

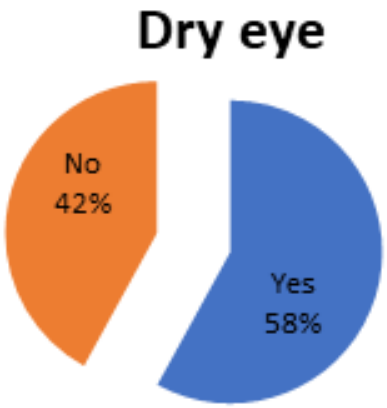

Figure 2: Showing prevalence of dry eye in studied patients

Table 1: Demographic profile of studied patients (N=51)

Demographic data		*No. of patients*	*Percentage (%)*
Age (In years)	20–25	2	3.9
	26–30	13	25.5
	31–35	14	27.5
	36–40	15	29.4
	>40	7	13.7
Mean ± SD(Min.-Max)		*34.53 ± 5.9 years (23–47)*	
Gender	*Male*	*35*	*68.6*
	Female	*16*	*31.4*
Comorbidity		4	7.8
Screen Time (in hours)	2–4	1	2.0
	5–6	34	66.7
	7–8	13	25.5
	>8	3	5.9
Mean ± SD (Min.-Max)		6.08 ± 1.5 hours (4-10)	

They also underwent tests like tear breakup time (TBUT) and Schirmer's test.[1]

Tear Break Up Time (TBUT)

TBUT was defined as the interval between the last complete blink and the appearance of the first dry spot. A sterile fluorescein strip (1-mg fluorescein sodium ophthalmic strip, sterile strips) was placed in the lower tarsus. The slit lamp was set to a 10X magnification using a cobalt blue light filter and time was recorded (when the first dry spot appeared). A TBUT >10 s was defined as normal, and a TBUT ≤10 s was defined as dry eye.

Schirmer Test

We proceed by placing a Schirmer's strip at the junction of the lateral 1/3 and medial 2/3 of the lower lid margin. Slow eyelid movements were allowed during the procedure. Moisture was considered normal if the strip was moistened over 10 to 30 mm, and hyposecretion was considered in cases of strip moistening less than 10 mm.

Then they were labeled as dry eye according to the result and treatment was given.

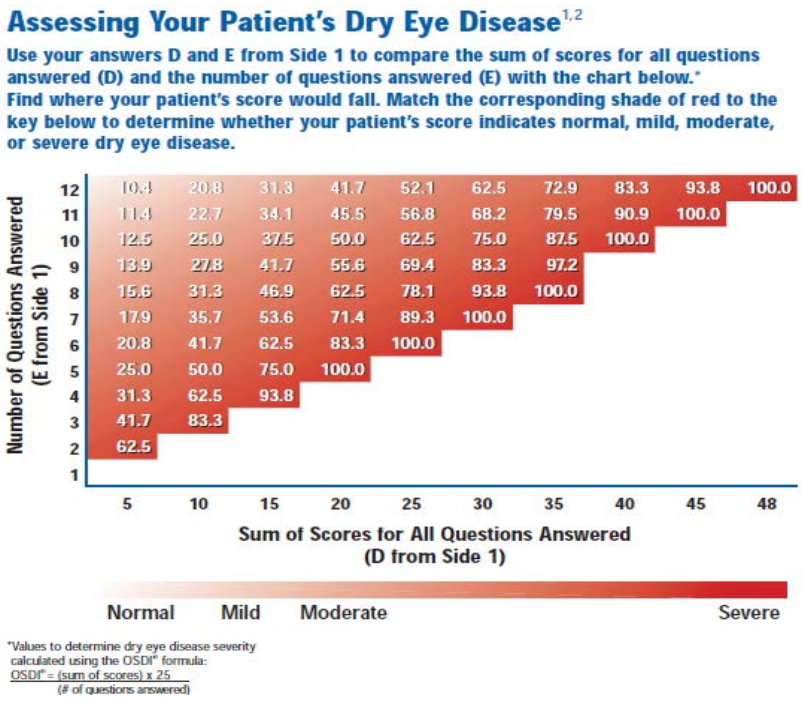

Figure 3: Assesement of dry eye score

Table 2: Showing Mean value of Schirmer 1, TBUT and OSDI in studied patients

Parameters	*Mean ± Std. Deviation*	*Range(Min-Max)*
Schirmer1	8.85 ± 1.2	5.5–11.5
TBUT	7.64 ± 2.4	4.0–12.5
OSDI	30.47 ± 13.1	10.40–62.50

Table 3: Distribution of grading of severity (N=51)

Grading	*Frequency*	*Percentage (%)*
Normal	22	43.1
Mild	21	41.2
Moderate	8	15.7
Severe	0	0.0

Table 4: Dry eye prevalence with different screen time

Screen time (hours)	*Sample*	*Dry eye*	*Percentage(%)*
2–4	1	1	100.0
5–6	34	15	44.1
7–8	13	11	84.6
>8	3	2	66.7

The 20-20-20 rule explained that at every 20 minutes spent using a screen, you should try to look away at something 20 feet away from you for a total of 20 seconds.

Artificial tears were prescribed in mild and moderate cases with varying frequency *i.e,* 3 to 4 times for mild cases, and frequency was increased in case of moderate cases.

Oral supplementation with essential fatty acids (EFAs) was suggested to patients with moderate dry eye.[64,97] EFAs are the precursors of eicosanoids, locally acting hormones involved in mediating inflammatory processes.[98] Essential fatty acids may benefit DED patients by reducing inflammation and by altering the composition of meibomian lipids.

Results

In this study, we included 51 subjects who were a regular user of mobile and computers. 35 (68.6%) of them were male and 16 (31.4%) were female. The mean age of patients was 34.53 ± 5.9 years ranging between 23–47 years. Mostly 56.9% of patients were in age 31 to 40 years. All 4 (7.8%) patients had diabetes mellitus as a comorbidity. The mean screen time was 6.08 ± 1.5 hours (Table 1). Before treatment, the mean Schirmer's, TBUT and OSDI test were 8.85 ± 1.2 mm (range 5.5–11.5 mm), 7.64 ± 2.4 seconds (range 4.0-12.5 seconds) and 30.47 ± 13.1 (range 10.40–62.50), respectively (Table 2). The prevalence of dry eye was 58% according to OSDI severity grading [Figure 1]. Among them, 41.2% had mild DED, 15.7% had moderate DED and none had severe DED (Table 3). Table 4 depicts the prevalence of dry is positively correlated to usage hours of computer/mobile. 81.2% of patients were 7 to 10 hours per day screen users.

After 20-20-20 rule and treatment, the Schirmer1, TBUT and OSDI tests were shown highly significant improvement ($p < 0.001$) (Table 5). According to grading, 78.4% had no DED and only 21.6% had mild DED after treatment (Table 6). It reflects a highly significant improvement post-treatment ($p < 0.001$).

Table 5: Comparison of Schirmer 1, TBUT and OSDI between pre and post treatment

Variables	*Pre-treatment*	*Post-treatment*	*p-value*
Schirmer1 (mm)	8.85 ± 1.2	12.79 ± 2.3	<0.001
TBUT (sec)	7.64 ± 2.4	9.32 ± 2.1	<0.001
OSDI	30.47 ± 13.1	54.46 ± 11.9	<0.001

Table 6: Comparison of severity grading before and after treatment

Grading	*Pre-treatment*	*Post-treatment*	*p-value*
Normal	22 (43.1%)	40 (78.4%)	<0.001
Mild	21 (41.2%)	11 (21.6%)	
Moderate	8 (15.7%)	0 (0.0%)	
Severe	0 (0.0%)	0 (0.0%)	

Table 7: Correlation of OSDI with Schirmer1 and TBUT

		Schirmer1	*TBUT*	*OSDI*
OSDI	Pearson correlation	0.082	-0.152	1
	p-value	0.568	0.286	-
	N	51	51	51

Table 8: Association of Schirmer1, TBUT and OSDI with severity grading post treatment.

Severity Grading		*N*	*Mean ± SD*	*p-value*
Schirmer1	Normal	40	13.37 ± 2.1	<0.001
	Mild	11	10.68 ± 1.9	
TBUT	Normal	40	10.06 ± 1.6	<0.001
	Mild	11	6.64 ± 1.7	
OSDI	Normal	40	52.36 ± 10.9	0.014
	Mild	11	62.12 ± 12.7	

OSDI was negatively correlated with Schirmer1 ($r = -0.152$; $p > 0.05$) and positive correlated with TBUT ($r = 0.082$; $p > 0.05$) but both correlations was insignificant (Table 7).

The mean of schirmer1, TBUT and OSDI according to severity grading is summarized in Table 8 which shows the significantly lower mean in mild category than normal cases in both Schirmer1 and TBUT except OSDI ($p < 0.001$).

Discussion

This study was aimed at assessing the prevalence of CVS and its treatment. This study was conducted on random 51 subjects who were regular mobile and computer SRMS IMS campus users. Out of 51 patients 35 (68.6%) of them were male and 16 (31.4%) were female. The mean screen time was 6.08 ± 1.5 hours.

In our study the prevalence of DED 58% as compared to previous studies that found a prevalence of 67.4% among computer office workers in Sri Lanka, 72% in the United Arab Emirates (UAE), among computer using university students, 80.3% in the Indian city of Chennai among medical and engineering university students, and 89.9% of five Malaysian universities students experience at least one of the CVS symptoms.[34-40]

Multiple studies have reported that participants experienced more pronounced symptoms after using the device for more than six hours or spending more than seven hours a day on the computer which was a significant predictor of CVS.[9] Also, in our study the average screen time was 6.08 ± 1.5 hours.

Upon assessing the preventive measures and treatment as advised was taken up by the participants to prevent CVS-related symptoms, a significant association was noted among students who applied the 20-20-20 rule and the reduced risk of CVS. Similarly, a study showed that taking frequent breaks every hour for five minutes decreases the discomfort associated with CVS.[35]

Reddy *et al.* added that looking at far objects frequently during work associated significantly with less frequent CVS symptoms.[14] Applying this rule showed improvement in work efficiency in previous studies.[36,37]

Proper location of the screen is another measure that showed significant correlation with reduced risk of CVS. Noticeably, most of the participants neglected the frequent blinking and using screen filters.

Ranasinghe *et al.* also if knowledge of ergonomics practice was higher among the mild-moderate CVS group than those reported sever CVS symptoms.

In our study 78.9% had no DED and 21.6% had mild DED after treatment and is highly significant ($p < 0.001$).

Conclusion

This study demonstrated that the prevalence of CVS was found more during covid era specially in computer user with prolonged screen time.

Hence, it is important to optimize the exposure time and improving the awareness among users.

The users must be trained about the non-pharmacological management like maintaining normal blinking, the use of appropriate lighting, careful positioning of the digital device, adjusting image parameters and following 20-20-20 rule.

Its high time now, every institution should come up with few guidelines in relation to high screen time of the desk job worker.

References

1. Lemp MA. Report of the National Eye Institute/Industry workshop on Clinical Trials in Dry Eyes. *CLAO J.* 1995; 21:221–32.
2. Lemp MA, Chacko B. Diagnosis and treatment of tear deficiencies. In: Tasman W, Jaeger E, editors. *Duane's Clinical Ophthalmology.* Philadelphia: Harper and Row; 1997.
3. Pellegrini M, Bernabei F, Scorcia V, Giannaccare G (2020) May home confinement during the COVID-19 outbreak worsen the global burden of myopia? *Graefes Arch Clin Exp Ophthalmol*. 10.1007/s00417-020-04728-2
4. Uchino M, Yokoi N, Uchino Y, Dogru M, Kawashima M, Komuro A, Sonomura Y, Kato H, Kinoshita S, Schaumberg DA, Tsubota K. Prevalence of dry eye disease and its risk factors in visual display terminal users: the Osaka study. *Am J Ophthalmol*. 2013; 156:759–66. doi: 10.1016/j.ajo.2013.05.040.
5. Computer vision syndrome (CVS). American Optometric Association Available from: http://www.aoa.org/x5374.xml Last accessed 2020 Aug
6. Blehm C, Vishnu S, Khattak A, Mitra S, Yee RW. Computer vision syndrome: a review. *Survey of ophthalmology.* 2005 May 1;50(3):253-62.
7. Yan Z, Hu L, Chen H, Lu F. Computer Vision Syndrome: A widely spreading but largely unknown epidemic among computer users. *Computers in human behavior.* 2008 Sep 1;24(5):2026-42.
8. Rosenfield M. Computer vision syndrome: a review of ocular causes and potential treatments. *Ophthalmic and Physiological Optics*. 2011 Sep;31(5):502-15.
9. Phamonvaechavan P. A comparison between effect of viewing text on computer screen and iPad® on visual symptoms and functions. *Siriraj Medical Journal*. 2017 Aug 19;69(4):185-9.
10. Iwakiri K, Mori I, Sotoyama M, Horiguchi K, Ochiai T, Jonai H, Saito S. Survey on visual and musculoskeletal symptoms in VDT workers. Sangyo eiseigaku zasshi= *Journal of occupational health*. 2004 Nov 1;46(6):201-12.
11. Sheppard AL, Wolffsohn JS. Digital eye strain:Prevalence, measurement and amelioration BMJ Open Ophthalmol. 2018;3: e000146
12. Maducdoc MM, Haider A, Nalbandian A, Youm JH, Morgan PV, Crow RW. Visual consequences of electronic reader use: *A pilot study Int Ophthalmol*. 2017; 37:433–9
13. Thomson WD. Eye problems and visual display terminals--The facts and the fallacies Ophthalmic Physiol Opt. 1998;18:111–9
14. Salibello C, Nilsen E. Is there a typical VDT patient? A demographic analysis. *Journal of the American Optometric Association*. 1995 Aug 1;66(8):479-83.
15. Cole BL, Maddocks JD, Sharpe K. Effect of VDUs on the eyes: report of a 6-year epidemiological study. Optometry and vision science: *official publication of the American Academy of Optometry.* 1996 Aug 1;73(8):512-28.
16. LIE I, WATTEN RG. VDT work, oculomotor strain, and subjective complaints: an experimental and clinical study. *Ergonomics*. 1994 Aug 1;37(8):1419-33.
17. Scheiman M. Accommodative and binocular vision disorders associated with video display terminals: diagnosis and management issues. *Journal of the American Optometric Association*. 1996 Sep 1;67(9):531-9.
18. Bhanderi DJ, Choudhary S, Doshi VG. A community-based study of asthenopia in computer operators. *Indian journal of ophthalmology*. 2008 Jan;56(1):51.
19. Titiyal JS, Falera RC, Kaur M, Sharma V, Sharma N. Prevalence and risk factors of dry eye disease in North India: Ocular surface disease index-based cross-sectional hospital study.

Indian journal of ophthalmology. 2018 Feb;66(2):207.
20. Kim DJ, Lim CY, Gu N, Park CY. Visual fatigue induced by viewing a tablet computer with a high-resolution display. *Korean Journal of Ophthalmology*. 2017 Jul 18;31(5):388-93.
21. Knave BG, Wibom RI, Voss M, Hedström LD, Bergqvist UO. Work with video display terminals among office employees:I. Subjective symptoms and discomfort Scand *J Work Environ Health*. 1985; 11:457–66
22. Ichhpujani P, Singh RB, Foulsham W, Thakur S, Lamba AS. Visual implications of digital device usage in school children: *A cross-sectional study BMC Ophthalmol*. 2019; 19:76
23. Shrestha GS, Mohamed FN, Shah DN. Visual problems among video display terminal (VDT) users in *Nepal J Optom*. 2011; 4:56–62
24. Alamri AA, Alhibshi N, Alnefaie M, Alzhrani W, Almaymuni A, Mosli M. Patterns of digital device usage and its related health effects on elementary and middle school students: An instrument development and regression analysis *Electron Physician*. 2018; 10:7333–40
25. Sheedy JE, Hayes J, Engle AJ. Is all asthenopia the same? *Optom Vis Sci*. 2003; 80:732–9
26. Nakamura S, Kinoshita S, Yokoi N, Ogawa Y, Shibuya M, Nakashima H, et al Lacrimal hypofunction as a new mechanism of dry eye in visual display terminal users *PLoS One*. 2010;5: e11119
27. del Mar Seguí M, Cabrero-García J, Crespo A, Verdú J, Ronda E. A reliable and valid questionnaire was developed to measure computer vision syndrome at the workplace *J Clin Epidemiol*. 2015; 68:662–73
28. Hayes JR, Sheedy JE, Stelmack JA, Heaney CA. computer use, symptoms, and quality of life Optom *Vis Sci*. 2007;84: E738–55
29. Park JS, Choi MJ, Ma JE, Moon JH, Moon HJ. Influence of cellular phone videos and games on dry eye syndrome in university students *J Korean Acad Community Health Nurs*. 2014; 25:12–23
30. Rosenberg ES, Asbell PA. Essential fatty acids in the treatment of dry eye. The ocular surface. 2010 Jan 1;8(1):18-28.
31. Ranasinghe P, Wathurapatha WS, Perera YS, Lamabadusuriya DA, Kulatunga S, Jayawardana N, Katulanda P. Computer vision syndrome among computer office workers in a developing country: an evaluation of prevalence and risk factors. *BMC research notes*. 2016 Dec;9:1-9.
32. Logaraj M, Madhupriya V, Hegde SK. Computer vision syndrome and associated factors among medical and engineering students in Chennai. *Annals of medical and health sciences research*. 2014;4(2):179-85.
33. Shantakumari N, Eldeeb R, Sreedharan J, Gopal K. Computer use and vision. related problems among university students in Ajman, United Arab Emirate. *Annals of medical and health sciences research*. 2014;4(2):258-63.
34. Reddy SC, Low CK, Lim YP, Low LL, Mardina F, Nursaleha MP. Computer vision syndrome: a study of knowledge and practices in university students. *Nepalese journal of Ophthalmology*. 2013 Sep 23;5(2):161-8.
35. Rahman ZA, Sanip S. Computer user: demographic and computer related factors that predispose user to get computer vision syndrome. *Int J Bus Humanit Technol*. 2011 Sep;1(2):84-91.
36. Is computer use a risk factor for myopia? [Mar;2019]; Mutti DO, Zadnik K. https://europepmc.org/article/med/8888885. *J Am Optom Assoc*. 1996 67:521–530.
37. Chiemeke SC, Akhahowa AE, Ajayi OB. Evaluation of Vision-Related Problems amongst Computer Users: A Case Study of University of Benin, Nigeria. InWorld Congress on Engineering 2007 Jul 2 (Vol. 1, No. 2, pp. 217-221).
38. B. S. Levy, G. R. Wagner, K. M. Rest, and J. L. Weeks, *Preventing Occupational Disease and Injury*, American Public Health Association, Washington, DC, USA, 2nd edition, 2005.
39. Misawa T, Yoshino K, Shigeta S. An experimental study on the duration of a single spell of work on VDT (visual display terminal) performance. Sangyo igaku. Japanese Journal of Industrial Health. 1984 Jul 1;26(4):296-302.
40. Izquierdo JC, García M, Buxó C, Izquierdo NJ. Factors leading to the computer vision syndrome: an issue at the contemporary workplace. Boletin de la Asociacion Medica de Puerto Rico. 2007 Jan 1;99(1):21-8.