



## **Computer Vision Syndrome Survey among the Medical Students in Sohag University Hospital, Egypt**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author MI designed the study, designed the study survey questionnaire and wrote the first draft of the manuscript. Authors AEM and ME performed the statistical analysis and wrote the protocol. Author HE managed the analyses of the study. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Purpose:** To analyze and describe the quantitative data of a specially designed well-structured questionnaire to survey the Computer Vision Syndrome (CVS) among the medical students in Sohag University, Egypt.

**Design:** A prospective descriptive non-comparative cross-sectional study.

**Methods:** 100 medical students included in this study (50 males and 50 females). After explanation of the nature of the CVS to the medical students, they fulfilled a specially designed form for CVS survey which included 20 questions of high validity and reliability.

**Results:** The most remarkable result in this study was recording that 86% of the medical students sample was used to spend 3 hours or more on a daily basis thus were complaining of one or more of CVS manifestations. Dry eye, headache, blurred vision, eye strain, neck and shoulder pain,

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fatigue and eye redness were recorded in 28%, 26%, 31%, 16%, 24%, 21% and 15% respectively. **Conclusion:** This study proved that CVS was a common syndrome that was simply misdiagnosed. Based on the survey performed in this study, 86% of the medical students were complaining of one or more of the CVS manifestations. This study recorded that dry eye, blurred vision, eye strain and headache were the most common CVS symptoms. This study recommended performing larger studies including many universities in Egypt, provided that the future studies should include both objective and subjective examination tools.

*Keywords: CVS; digital eye strain; dry eye disease; digital screens; smart phones.*

## 1. INTRODUCTION

In general, the definition of the computer vision syndrome (CVS) was referred to the American Optometric Association (AOA) which defined the CVS as a complex of eye and vision problems resulting from the activities which stress the near vision during the use of the computers and digital screens. Vision affection results from interaction with digital screens, computer display or their environment [1].

The daily use of personal computers and digital screens for 3 hours or more makes the person is at high risk of developing CVS, Occupational Overuse Syndrome (OOS), headache and psychosocial stress [2].

In modern life today, millions of people including children and students are unfortunately accustomed to use the digital screens and computers for very long hours. A video display terminal (VDT) is now considered as a computer screen. What make things worse are the new bad habits of the school and university students to study their subjects using the computers instead of the classic book studies. In addition they are playing games and watching movies on the digital screens [3].

Computer Vision Syndrome is also known as Digital Eye Strain (DES). CVS or DES is usually related to watching the computers or digital screens that make the near work of the eye more difficult. The high visual requirements and visual attention makes any computer user susceptible developing VCS or DES [4].

The main symptoms of CVS are eyestrain, headache, dry eyes sensation, blurred vision, tearing, burning of eyes, watering of eyes, photo phobia, red eyes, burning, itching, neck and shoulder pain, and contact lens troubles [1,5].

The possible pathophysiological mechanism of CVS is three mechanisms: extra ocular

mechanism, accommodative mechanism and ocular surface mechanism [1].

One or more factors could be responsible for the development of CVS. These factors are infrequent blinking, uncomfortable sitting position, prolonged continues looking at the digital screens, improper lightening conditions, ammetropia, glare and incorrect distances between the eye and the computer [5].

In Africa, unfortunately the studies on CVS are limited. Furthermore the use of preventive measures of CVS is still handicapped thus augmenting the manifestations of CVS experienced by the computer users [6].

Actually, several studies reported CVS as a serious problem associated with long-term ocular and musculoskeletal complains that affects the health of the eyes and the body. Furthermore, CVS has a negative influence on the life style, work and family relationships. Many authors suggested several measures to treat or at least alleviate the severity of CVS manifestations. These measures included treatment of any refractive errors with glasses, treatment of the dry eye disease with tears substitutes and lubricants, use of specially designed glasses for the digital screens and use of screen filters. In addition, it was also recommended that the use of the digital screens should be in an interrupted short several screen time periods distributed along the day not exceeding 1 hour in each period. Another recommendation was to have at least 15-20 minutes break every 2 hours of continuous digital screen usage. The proper room lighting, people education, periodic ocular examination and adequate adjustment of the distance between the eye and the digital screens were other measures to guard against CVS [7-16].

## 2. METHODS

The aim of this study was to perform a survey to detect the prevalence and severity of the CVS

among a sample of 100 medical students in Sohag University, Egypt. The design of this study was a prospective descriptive non-comparative cross-sectional study. The approval of the ethical committees in faculty of medicine in Sohag University was taken. The survey was performed among medical students after full explanation of the CVS questionnaire form to be fulfilled according to the personal habits of every medical student shared in this survey.

### **2.1 CVS Survey Questionnaire Form**

The authors in this article created a new survey questionnaire which was an own-made one designed especially for this study for the first time ever introduced in a study concerning the CVS survey. The questionnaire form included 20 questions designed by the authors and related to the personal data and habits of the medical students. To facilitate the recording and the interpretation of results the authors used the term (screen-hours) to describe the number of hours the student spend every day on his computer or smart phone screens. Meanwhile, the authors use the term (screen-years) to describe the number of years the student previously spent watching his computer or smart phone screens with his/her routine screen-hours.

These 20 questions included age, gender, the frequent computer digital screen use, the hours the student spend every day on his screen, the hours the student spend on his screen in dark room, whether the student screen-hours are continuous or interrupted, the illumination level of the screen in room light, the screen-hours the student spend more during the day or at night, the presence of any symptoms of complaints related to CVS, whether the student using eye drops or not, is the student suffering from dry eye disease or not, the presence or absence of the refractive errors, whether the student is using glasses or contact lenses, whether the student is seeing the details of objects clear or hazy after prolonged screen-hours, any complains in the fingers, wrists or shoulders of the student using smart phones, the number of screen-years the student spent on his screen, whether the student is using touch screen, touch pad, not pen or the mouse and keyboard, whether the student believes that CVS affects his life style and eye health or not and finally whether the student is willing in the future to decrease his screen-hours. Fig. 1 shows the CVS questionnaire form.

### **2.2 CVS Excel Sheet and Statistical Analysis**

Microsoft Excel (Microsoft Office 2010) was used to get the CVS Excel sheet that was used by authors for data input to enter the answers of the CVS questionnaire form fulfilled by the medical students. Thereafter, the data in the CVS Excel sheet was used for statistical analysis of the results of the CVS questionnaire form. Data were analyzed using the statistical package for social sciences software (SPSS version 22 for Windows). Quantitative data were described using median, mean and standard deviation. . Qualitative data was presented as number and percentage. Paired Samples T-test was used for normally distributed data while Wilcoxon test was used for non-normally distributed data.

### **3. RESULTS**

This study included 100 medical students (50 males and 50 females). Age ranged from 18 to 24 years.

So, this study included 20 questions. The structure of many questions of this questionnaire allowed the medical students to choose more than one answer for the same question which explains the presence of different percentages for the same question.

The first question was about the age of the medical students and the results were 18 years old (7%), 19 years old (14%), 20 years old (31%), 21 years old (18%), 22 years old (21%), 23 years old (7%) and 24 years old (2%). The second question was about the gender and the results were 50 medical students were males (50%) and 50 students were females (50%).

The third question was about the frequent computer digital screen used by the medical students and the results were 9% of the students were using the ordinary computer screen, 73% of the students were using laptops, 43% of the students were using Tablets/iPads/Notes, and 81% of the students were using Android mobiles (eg. Samsung) while only 7% of the students were using Apple mobiles (iPhone). This is because most of the medical students were using more than one type of digital screens.

The fourth question was about how many hours the medical students usually was spending on their digital screens. The results were 5% of the students used to spend < 1 hour, 9% of the

students used to spend 1-2 hours, 21% of the students used to spend 2-3 hours, 24% of the students used to spend 3-4 hours, 27% of the students used to spend 4-6 hours while 14% of the students used to spend > 6 hours on their digital screens.

### Computre Vision Syndrome (CVS) Survey Form

Please Mark your answers (✓):

Date:    /    /

(Note that you may choose 1 or more answers for each question)

• Age:    18     19     20     21     22     23     24

• Gender:    Male     Female

• The frequent computer digital screen you use:

Ordinary Computer Screen	<input type="checkbox"/>	Laptop	<input type="checkbox"/>	Tablet/iPad/Note	<input type="checkbox"/>
Android Mobile (eg. Samsung)	<input type="checkbox"/>	Apple Mobile (iPhone)	<input type="checkbox"/>		

• How many hours do you spend on your digital screen ?  
 < 1 h     1-2 h     2-3 h     3-4 h     4-6 h     > 6 h

• How many hours you spend watching your screen in dark room ?  
 < 1 h     1-2 h     2-3 h     3-4 h     4-6 h     > 6 h

• The hours you spend on your digital screen are:    Continuous     Interrupted

• To what level you illuminate your digital screen (brightness) in room light ?  
 ≤ 10 %     11%-25%     26%-50%     51%-75%     76%-100%   

• Are you spending most of your screen time during the day or during the night ?  
 The day     The night   

• Do you have any of the following symptoms ?

Headaches	Blurred vision	Neck/shoulder/back pains
Fatigue	Eye strain	Eye redness and irritation
Dry eyes	Double vision	Difficulty refocusing the eyes

• Do you have a previously diagnosed Dry Eye Diseases ?    Yes     No

• Are you using any topical eye drops for this dry eye ?    Yes     No

• Do you have any refractive errors ?  
 Yes     No     I don't know

• Are you wearing glasses or contact lenses ?    Yes     No

• Describe the details of objects you see after prolonged hours on your digital screen:

Clear     Blurred     Hazy

• After using my smart phone for prolonged hours, I am complaining of:

Joint pain in my fingers and wrists	Inability to hold objects well
Difficulty to write using the pen	Shoulders pain <input type="checkbox"/> None <input type="checkbox"/>

• How many years did you spent this way on the screen:  
 Nearly 1 y     Nearly 2 y     Nearly 3 y     Nearly 4 y     ≥ 5 years

• I am frequently using:  
 Touch Screen     Touchpad     Note Pen     Mouse and keyboard

• Are you usually studying MEDICINE using:    Screens     Books     Both

• Do you feel that the digital screens affects your life style and eye health ?    Yes     No

• Are you willing to decrease your screen hours to guard against CVS ?    Yes     No

**Fig. 1. CVS questionnaire form**

The fifth question was about how many hours the medical students used to spend watching their digital screens in the dark room. The results were 16% of the students used to spend < 1 hour, 23% of the students used to spend 1-2 hours, 19% of the students used to spend 2-3 hours, 17% of the students used to spend 3-4 hours, 18% of the students used to spend 4-6 hours while 7% of the students used to spend > 6 hours on their digital screens in the dark room.

The sixth question was about whether the hours the medical students used to spend on their digital screen continuous or interrupted. The results were 34% of the students were spending continuous hours while 66% of the students were spending interrupted hours on their digital screen.

The seventh question was about the level of the illumination of the digital screens that the medical students used to in the room light. The results were 5% of the students were using  $\leq$  10% screen brightness, 26% of the students were using 11%- 25% screen brightness, 33% of the students were using 26%-50% screen brightness, 28% of the students were using 51%-75% screen brightness, 8% of the students were using 76%-100% screen brightness.

The eighth question was about the most preferred time for the medical students to use their screens during the day or the night. The results were 13% of the students were spending most of their screen hour during the day while 87% of the students were spending these hours during the night.

The ninth question was about the symptoms related to CVS that the students complained of. The results were 26% of the students complained of headache, 21% of the students complained of fatigue, 28% of the students complained of dry eye, 31% of the students complained of blurred vision, 16% of the students complained of eye strain, 1% of the students complained of double vision, 24% of the students complained of neck/shoulder/back pain, 15% of the students complained of eye redness and irritation while 8% of the students complained of difficulty in refocusing the eye.

The tenth question was about the presence of a previously diagnosed dry eye disease. The results of this question were 28% of the students had a previously diagnosed dry eye disease while 72% of them did not.

The eleventh question was about using any topical eye drops as a treatment for this previously diagnosis dry eye. The results of this question were 13% of the students were using topical eye drops to treat their dry eye disease while 87% of the students did not use any eye medication.

The twelfth question was about the presence of any refractive errors. The results of this question were 75% of the students had refractive errors, 16% of the students had no refractive errors while 9% of the students did not know their refractive status.

The thirteenth question was about wearing glasses or contact lenses. The results of this question were 72% of the students were wearing glasses or contact lenses while 28% of the students were not wearing any glasses or contact lenses.

The fourteenth question was about the descriptions of the details of the objects after prolonged hours of using the digital screens. The results of this question were 67% of the students were seeing clear details of the objects after prolonged hour on their digital screens while 33% of the students were seeing blurred details of the objects after prolonged hours on their digital screens.

The fifteenth question was about the presence of any complains after using the smart phones for prolonged hours. The results of this question were 43% of the students were complaining of joint pain in their fingers and rests after using their smart phone for prolonged hours, 39% of the students were complaining of shoulder pain, 7% of the students were complaining of inability to hold the objects well, 5% of the students were complaining of difficulty to write using the pen while 6% of the students had no such complains.

The sixteenth question was about the years each student spent this way and these hours on the digital screens. The results of this question were 2% of the students spent nearly 1 year, 3% of the students spent nearly 2 years, 20% of the students spent nearly 3 years, 41% of the students spent nearly 4 years, 34% of the students spent  $\geq$ 5 years on their digital screens.

The seventeenth question was about the type of the digital screen the students frequently used during these years. The results of this question were 92% of the students used the touch screens, 27% of the students used the

touchpads, 2% of the students used the Note Pens while 36% of the students used the mouse and keyboard. This is because many students had more than one choice in this question.

The eighteenth question was about the usual tool used by the students to study medicine. The results of this question were 6% of the students were using the digital screens to study medicine, 61% of the students were using the books to study medicine while 33% of the students were using both books and digital screens to study medicine.

The nineteenth question was about the feeling whether the digital screens affected the life style and the eye health of the students or not. The results of this question were 91% of the students felt that the digital screens affected their life style and eye health while 9% of the students confirmed that the digital screens had no effects on their life style or eye health.

The twentieth question was about the willing of the students to decrease their screen hours to guard against CVS. The results of this question were 76% of the students were willing to decrease their screen hours to avoid CVS while 24% of the students confirmed that they will not decrease their screen hours.

#### **4. DISCUSSION**

Nowadays, modern life style obliged the whole world to shift to the modern technology where the digital screens are the masterpiece of this life process. The emergences of portable and handheld digital screens have multiplied the number of devices used by human kind hundreds of times. In fact, smart phones have become so popular that almost all teens and adults have one or more of these smart phones. In the last decade, the emergences of the social medias and its applications such as Facebook, Twitter, WhatsApp, YouTube and other social medias and applications have made a revolution in the life style of all mankind who shifted his interest towards entertainment, communications and watching audio-video medias that unfortunately have been consuming most of his spare time on smart phones and digital screens on the expense of his life style and relationships with his family, friends, colleagues and other humans.

By far, the most important landmark in defining CVS is the definition released officially from the American Optometric Association which defined

the Computer Vision Syndrome (CVS) or in another expression the Digital Eye Strain (DES) as a collection of ocular and extra ocular manifestations resulting from using the digital screens for prolonged hours. Most people who have CVS usually complain of eye strain, headache, dry eye, pain in the neck, shoulders and or the back, eye redness and or irritation, fatigue and ocular discomfort. The severity of CVS manifestation depends on the how much time people spend on the digital screens. In general, people who are accustomed to spend 3 hours or more regularly on a daily basis are mostly complaining of CVS.

In this study, the authors were aiming hard to do a good survey on CVS among medical students in Sohag University, Egypt thus were trying to reach a near close to the truth of the prevalence and severity of CVS manifestations from an actual direct survey among the medical students.

This study was carried on a sample of the medical students as a survey to have a provisional idea about the percentage of the medical students that is complaining of CVS. The sample in this study included 100 medical students (50 males and 50 females). Age ranged from 18 to 24 years.

Surprisingly enough, 86% of the medical students sample was accustomed to using their digital screens 3 hours or more daily which made them very liable to suffer from one or more of CVS manifestations. What's more amazing is that 34% of the medical students were spending these prolonged hours continuously on their digital screens. That's why this study recorded a relatively high percentage of medical students complaining of CVS manifestations. For example 28% of the medical students were complaining of dry eye while 13% of the students were actually using topical eye drops to treat the dry eye, 31% of the medical students were complaining of blurred vision, 24% of the medical students were complaining of neck, shoulder and or back pain while 16% of the medical students were complaining of eye strain. Headache and fatigue were recorded in 26% and 21% of the students respectively.

This study recorded a clear fact that smart phones were mostly the main cause of CVS in these students because this study recorded that 88% of the medical students sample were using smart phones, furthermore, 92% of the students were using the touch screens.

Akinbinu T. and Mashalla Y. [6] performed a similar study as they reported their results in Abuja, Nigeria. In their study, the data was collected from 100 (54 males and 46 females respondents) bank employees aged from 18 to 40 years. In a comparison with this study, the survey included a sample of 100 medical students (50 males 50 females) aged from 18 to 24 years in Sohag University, Egypt. In their study, Akinbinu T. and Mashalla Y. [6] used a semi-structured questionnaire containing 22 items developed by the researcher using question items from previous studies. Meanwhile, this study aimed to perform a survey on a sample of the medical students using a form consisted of 20 questions designed by the authors to be of high validity and reliability.

Reddy S et al. [3] performed a survey on university students in Malaysia. Their study included 795 students aged from 18 to 25 years. They recorded that the prevalence of the CVS manifestations was 89.9% among the university students. They recorded headache in 19.7 of the students and eye strain in 16.4% of the students. Moreover, they stated that students who were using the digital screens 2 or more hours daily were complaining of one or more of the CVS manifestations. In a comparison with this study, the survey was performed on a sample of 100 medical students which was much lower than their survey sample. The major close result between both studies was the recording of CVS prevalence in 89.9% in their study based on the 2 hours daily basis use of the digital screens which is so close to the prevalence recorded in this study of 86% of students based on the 3 hours daily basis use of the digital screens.

Furthermore, this study included only medical students while their study included all university students. In addition, in this study headache was recorded in 26% of the medical students which represented a higher percentage than their study while eye strain was recorded in 16% which represented a very close percentage of their study. However, in this study dry eye and blurred vision were recorded in 28% and 31% of the students respectively. Another important difference between both studies is that they considered a regular 2 hours daily is the start of complaining of CVS symptoms while this study recorded the start of CVS manifestation when using regular 3 hours daily on digital screens. These differences may be attributed to the large survey sample of their study versus the small survey sample in this study.

Logaraj M, Madhupriya V and Hegde SK [13] reported in their study that more than 75% of the engineering students were affected with CVS. Their results were close to our results in this study on the medical students [13].

Several studies demonstrated the drawbacks of CVS on human health and productivity. They revealed that CVS is a main cause of time consuming, visual function affection and mental stress. This will end in decreasing the actual work-time hours, less productivity, absence from work and even lack personal life care and interests. That's why these studies suggested the use of special campaigns and advertisement in schools, universities and media to create a new era of public awareness regarding risks and drawbacks of CVS on health, work and life style [10-16].

The major disadvantage of this study was being an objective study that did not included any subjective tools to evaluate the medical students and to link the results of the survey to complete ophthalmological examination of the students' eyes.

By far, the CVS survey questionnaire form included in this study is the first of its kind and its unique design performed by the authors of this study has no match till now according to the authors' knowledge.

## 5. CONCLUSION

This study proved that CVS was a common syndrome that was simply misdiagnosed. Based on the survey performed in this study, 86% of the medical students were complaining of one or more of the CVS manifestations. This study recorded that dry eye, blurring of vision, eye strain and headache were the most common CVS symptoms. This study recommended performing larger studies including many universities in Egypt, provided that the future studies should include both objective and subjective examination tools.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee

has been collected and preserved by the authors.

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## COMPETING INTERESTS

The authors declare that they have interests regarding the survey questionnaire they created especially for this study.

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