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Original article

Computer visual syndrome in graduate students of a private university in Lima, Perú☆

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ABSTRACT

Background: In recent decades, several studies have found a strong association between prolonged use of video display terminals and ophthalmological symptoms encompassed in the so-called computer visual syndrome (CVS). Few studies have addressed this syndrome in graduate students.

Methods: Observational, cross-sectional descriptive study. A total of 106 postgraduate students were surveyed without ophthalmological pathologies. The diagnosis of CVS was made by means of the questionnaire of Seguí et al. validated in Spanish, which evaluates the frequency and intensity of 16 ocular symptoms.

Results: The prevalence of CVS among graduate university students was 62.3% (95% CI: 52.3–71.5). It was found that the highest proportion of students with the syndrome was in the group of older than 40 years old (88.2%) and in the group 21–30 years old (70.0%), showing statistically significant differences (p = 0.004). According to the device and its time of use, students who used the mobile phone for 7–10 h a day showed a higher prevalence of CVS compared to those who used the device for less time (p = 0.030). The business School had the highest prevalence (75.0%).

Conclusion: Three out of every five graduate students presented CVS with this prevalence being like reported in other populations. There is a need to investigate possible interventions that can help reduce this entity.

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Síndrome visual informático en estudiantes universitarios de posgrado de una universidad privada de Lima, Perú

Palabras clave:
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Problemas de visión
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RESUMEN

Antecedentes: En las últimas décadas diversos estudios han encontrado una fuerte asociación entre el uso prolongado de los videoterminales y síntomas oftalmológicos englobados en el denominado síndrome visual informático (SVI). Pocos estudios han abordado este síndrome en estudiantes de posgrado.

Métodos: Estudio observacional, descriptivo de corte transversal. Se encuestó a 106 estudiantes universitarios de posgrado sin patologías oftalmológicas. El diagnóstico de SVI se realizó mediante el cuestionario de Seguí et al. validado en castellano, el cual evalúa la frecuencia e intensidad de 16 síntomas oculares.

Resultados: La prevalencia de SVI de los estudiantes universitarios de posgrado fue del 62,3% (IC 95%: 52,3–71,5). Se encontró que la mayor proporción de estudiantes con el síndrome estuvo en el grupo mayor de 40 años (88,2%) y en el grupo de 21–30 años (70,0%), mostrando diferencias estadísticamente significativas (p = 0,004). Según el dispositivo y su tiempo de uso se observó que los estudiantes que utilizaban el teléfono móvil de 7 a 10 h diarias presentaron una prevalencia de SVI mayor en comparación con quienes utilizaban el dispositivo menos tiempo (p = 0,030). La Facultad de Ciencias Empresariales presentó la prevalencia más elevada (75,0%).

Conclusión: Tres de cada cinco estudiantes universitarios de posgrado presentaron SVI, siendo esta prevalencia similar a lo reportado en otras poblaciones. Es necesario que se investiguen posibles intervenciones que puedan ayudar a reducir esta entidad.

Introduction

The use of devices with monitors known as Video Terminals (VDT) (computer, mobile phone, tablet) has increased considerably in recent decades. Exposure to VDT has been associated with dermatological conditions, muscle-skeletal disorders and visual symptoms.[1] The latter are encompassed in the so-called computer visual syndrome (CVS).[2]

Several studies have found a strong association between the prolonged use of VDTs and ophthalmological symptoms with a directly proportional correlation.[3–5] Worldwide, among VDT users, ophthalmological symptoms prevalence varies from 64 to 90%. It is estimated that approximately 60 million people present this syndrome.[6,7] In the population of university students, this syndrome is much more prevalent, reaching in some cases up to 81% of affected students.[8] This phenomenon is explained by the frequent use of VDT for academic activities, entertainment and social media. It has been observed that symptoms significantly increase in students that use computers for more than 2 h. The main ocular symptoms referred by subjects are eye fatigue, irritation, burning sensation, redness, blurred vision and double vision.[7] Said symptoms can negatively impact students' daily work, affecting their productivity, efficiency, time administration, health and general well-being.

Although CVS can be easily prevented decreasing the hours of computer use, a million new cases are reported worldwide every year.[6] In South America, evidence is limited. In Peru, only one study published in 2012 has explored this topic. Prevalence of visual fatigue in hospital digitizers was reported at a 59%.[9] There is no evidence regarding CVS frequency in university graduate students. Being a population at high-risk of presenting CVS due to frequent use of VDT devices, and acknowledging the negative effect in productivity that the syndrome can have, this study aimed to describe CVS prevalence in university graduate students from a private university in Lima, Peru.

Methodology

Study design

Observational type study, cross-sectional descriptive in Postgraduate School students of a private university located in Lima, capital of Peru.

Population and sample

The population of the study comprised 410 college students enrolled in the first half of 2019. Sample size was calculated on the NetQuest website with the following considerations: 5% error margin, 95% confidence interval and an expected proportion of students with CVS of 50%. A total sample of 199 surveyed students was obtained. Around 200 students filled in a survey, although 7 were poorly executed and therefore not included in the analysis. Of the remaining, 87 participants that referred having any of the refractory pathologies evalu-

ated (57 referred myopia, 40 astigmatism and 21 hyperopia) were excluded. The final sample to analyze was 106 students.

Main variable

To classify participants as CVS, the survey used was validated by Seguí et al. in which frequency and intensity of 16 ocular symptoms were evaluated: (i) burning; (ii) itching; (iii) foreign body sensation; (iv) tearing; (v) excessive blinking; (vi) ocular redness; (vii) eye pain; (viii) heavy eyelids; (ix) ocular dryness; (x) blurred vision; (xi) double vision; (xii) difficulty to focus up close; (xiii) increased light sensitivity; (xiv) colored halos surrounding objects; (xv) feeling of seeing worse, and (xvi) headache. Frequency was evaluated in 3 categories with a score from 0 to 2 (never = 0, seldom = 1, usually or always = 2) and intensity with 2 categories (moderate = 1, intense = 2). If a symptom was marked as never presented, the intensity question was not filled. To calculate the final score, first the symptoms' frequency score for intensity is multiplied. Subsequently, this result is recoded as a 0 = 0, 1 or 2 = 1 and 4 = 2. Finally, the result is added to each of the symptoms. A score greater than or equal to 6 includes an individual in the CVS category. This survey was applied to each device subjects referred to use, evaluating in which CVS was present more frequently. Likewise, the frequency of exposure to devices with VDT (mobile phone, electronic tablet, computer), general factors (age, sex, faculty) and ophthalmological refractive background (use of glasses, myopia, hyperopia, astigmatism) was evaluated. Ophthalmological records were evaluated in order to exclude students that have these expressions, since they can cause CVS symptoms.

Data collection and processing

The instrument was applied during class hours, with permission from the teacher in charge. The pollsters were research team members that gave instructions for the correct filling of the form and made a voluntary invitation to participate. Afterwards, complete surveys and signed informed consents were digitized with the Microsoft Excel 2016 program.

Statistical analysis

The database was imported into the statistics program R V3.2 where the analysis was performed. Categorical variables were tabulated in absolute and relative frequencies. Furthermore, prevalence of general CVS was also determined by gender, age, faculty and device time use. Bivariate comparisons were made with the chi square test.

Ethical considerations

This project was approved by the Faculty of Health Sciences ethics committee from the Peruvian Union University. All participants gave their informed consent prior to data collection. No personal data were recorded, respecting the privacy and confidentiality principles of the World Medical Association's Helsinki declaration.

Table 1 – Sociodemographic characteristics and computer visual syndrome in graduate students.

Characteristics	Computer visual syndrome		p*
	No = 40 (37.7%)	Yes = 66 (62.3%)	
Sex			0.207
Female	13 (29.5%)	31 (70.5%)	
Male	27 (43.5%)	35 (56.5%)	
Age group			0.004
21–30	9 (30.0%)	21 (70.0%)	
31–35	8 (33.3%)	16 (66.7%)	
36–40	21 (60.0%)	14 (40.0%)	
>40	2 (11.8%)	15 (88.2%)	
Faculty			0.328
Education	10 (31.2%)	22 (68.8%)	
Business	4 (25.0%)	12 (75.0%)	
Health	9 (39.1%)	14 (60.9%)	
Theology	17 (48.6%)	18 (51.4%)	
Uses laptop			0.547
No	2 (66.7%)	1 (33.3%)	
Yes	38 (36.9%)	65 (63.1%)	
Uses mobile phone			0.361
No	1 (100%)	0 (0.0%)	
Yes	39 (37.1%)	66 (62.9%)	
Uses tablet			0.751
No	31 (39.2%)	48 (60.8%)	
Yes	9 (33.3%)	18 (66.7%)	

* Calculated with the chi square test.

Results

Out of the 106 graduate students included in the study 58.5% were men and 41.5% women. The average age was 34.4 ± 6.1 years. In total, 33.0% belonged to the Faculty of Theology, 30.2% to the Faculty of Education, 21.7% to the Faculty of Health Sciences and 15.1% to the Faculty of Business Sciences. A majority of 99.1% reported using mobile phones, 97.2% laptops and 74.5% electronic tablets. CVS prevalence was 62.3% (CI 95%: 52.3–71.5).

Table 1 shows the relation between sociodemographic characteristics and CVS. It was found that a greater proportion of female students (70.5%) presented CVS than male students (56.5%), but without statistically significant differences. Regarding the age group, it was discovered that the largest proportion of students with CVS was in the 21–30 year group (70.0%) and in the over 40 years group (88.2%), showing statistically significant differences (p = 0.004). In the Faculty of Business Sciences 75.0% of the students presented CVS, being the faculty with the highest prevalence. Out of the students that referred using a laptop, 63.1% presented CVS.

Table 2 shows CVS prevalence according to the device and its time of use. Among the students that use laptops, the group that had the highest CVS incidence was the one that worked with them from 7 to 10 h per day (63.6%); however, this did not differ much from that found in the group that used them 1–3 h per day (63.0%). Regarding the use of mobile phones, it is observed that 66.7% of students that used the device from 7 to 10 h per day presented CVS. On the contrary, in groups that used the device from 1 to 3 h or 4 to 6 h per day the syndrome's incidence was much lower, 32.5% and 34.0%, respectively. This

Table 2 – Prevalence of computer visual syndrome according to the device used and time of use in postgraduate students.

Characteristics	Computer visual syndrome		p*
	No	Yes	
Using laptop (103)			
General	44 (42.7%)	59 (57.3%)	
1–3 h per day	10 (37.0%)	17 (63.0%)	0.504
4–6 h per day	26 (48.1%)	28 (51.9%)	
7–10 h per day	8 (36.4%)	14 (63.6%)	
Using mobile phone (105)			
General	64 (61.0%)	41 (39.0%)	
1–3 h per day	27 (67.5%)	13 (32.5%)	0.030
4–6 h per day	31 (66.0%)	16 (34.0%)	
7–10 h per day	6 (33.3%)	12 (66.7%)	
Using tablet (27)			
General	19 (70.4%)	8 (29.6%)	
1–3 h per day	15 (71.4%)	6 (28.6%)	1.000
4–6 h per day	3 (75.0%)	1 (25.0%)	

* Calculated with the chi square test.

difference is expressed in a statistically significant manner (p = 0.030). Finally, regarding the use of electronic tablets, there were no significant differences between proportions.

Discussion

Computers and devices with VDT have become one of the main tools for college students; simultaneously, CVS has arisen as a frequent health problem in this population. In the studied sample CVS prevalence was 62%, without significant differences between males and females. The most frequently used devices were mobile phones and laptops. Out of the participants with CVS, 66.7% reported using mobile phones from 7 to 10 h a day, this amount of hours being much greater than that of the general population, where an average use of around 3 h and 40 min[10] is estimated.

CVS prevalence in the studied sample was similar to that reported by other research in university students that presented incidence levels of 51–71%.[9,11,12] It must be taken into account that the symptom assessment tool associated to CVS has been different in between the studies; in our case we use the questionnaire validated by Seguí et al.[13] No differences were found between male and female prevalence; however, there are reports that indicate that this syndrome is more frequent in women.[12] The majority of students belonged to business sciences; similar to what is reported by Tawil et al., who showed that business career students presented CVS 1.6 more times than medicine students.[6] The most frequently used devices were mobile phones and laptops, as reported in other studies.[11] It is interesting to note that students that reported being exposed to screens between 1 and 3 h had a CVS prevalence similar to those that were exposed from 7 to 10 h. These figures concur with the reported by Mowatt et al., where more than 40% of participants used devices for more than 6 h; however, no significant difference for this factor[8] was found. Reddy et al. reported that 90% of the evaluated students that presented symptoms associated to CVS used computers for more than 2 continuous hours per day,[14] and it has even been reported that exposure of only 1 continuous hour to an electronic tablet screen can increase astenopia signs.[15]

Although the physiopathological mechanisms that cause CVS are not yet fully understood, it is believed that decrease of the blinking rate and greater accommodation efforts are two possible underlying causes.[15,16] Portello et al. reported that lack of blinking or incomplete blinks were associated to an increase in CVS[17] symptoms. In addition, during computer screen use, especially on desktop screens, users usually adopt an angle of sight that exposes a greater ocular surface area compared to reading with low gaze,[16] which could explain the dry eye feeling and ocular discomfort. Simultaneously, computer work demands saccadic accommodation (continuous focusing) and verge (alignment) eye movements, all of which imply constant muscle activity.[18,19] The screen pixel density significantly influences image quality and, therefore, visual performance. It has been shown that low image quality increases visual effort which in turn increases visual fatigue and dry eye symptoms.[16,20] Another associated mechanism is exposure to blue light; it has been shown that decreasing exposure to this light reduces visual fatigue.[21] Finally, some of the most common causes of visual fatigue during the use of computers or devices with VDT include uncorrected refractive errors and presbyopia.

The present study's findings are important because they provide information on a very frequent but underreported syndrome in the country and it could have repercussions on the quality of life of people that are affected by it. Being able to identify some of the factors related to this syndrome allows the proposal of strategies to avoid its appearance or improving the conditions of the vulnerable population, university students in particular. Reddy et al. indicated that strategies such as looking at distant objects for some time during work, looking at the monitor from below eye level, ocular massages and using eye lubricants helped reduce symptoms. In contrast, taking regular pauses during work and using screen filters to reduce r̈adiationẅere not useful.[13] It is clear that regular ophthalmological examinations should be carried out to maintain visual health and prevent CVS.

This study had some limitations that must be addressed. In the literature, other factors associated to development of CVS have been identified, such as distance to the VDT device, screen brightness intensity and environmental light among others that could not be analyzed in this study.[6,12] These variables must be considered in future research. Another important limitation to remark is that ophthalmological antecedents and device time use were self-reported; therefore there could be memory bias. Finally, this study was carried out in a single headquarter; thus results can only be extrapolated to this population. However, there was a university population of diverse careers and age groups that could reasonably have sociodemographic and cultural characteristics similar to other university populations of Peru.

Conclusion

In conclusion, 3 out of 5 graduate college students exhibited CVS, a similar prevalence to that reported in other popula-

tions. This syndrome becomes particularly relevant in the context of the Covid-19 pandemic, where screen exposure hours have increased.[22] It is recommended to expand the study of factors associated to CVS in future investigations and also possible interventions that could help reduce this pathology.

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Conflict of interest

No conflicts of interests have been declared by the authors.

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