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EVALUATION OF OCULAR SYMPTOMS OF COMPUTER VISION SYNDROME IN SMARTPHONE USERS

Ophthalmology

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ABSTRACT

Objectives: Computer vision syndrome (CVS) is the ocular and vision problems related to computer usage resulting in reduced productivity and quality of life. The aim of the study was to document ocular symptoms and the role of refractive error associated with smartphone usage.

Methods: A cross sectional study of 100 medical students with a structured questionnaire regarding their smartphone use, ocular symptoms, duration of use and refractive error if any was documented. Chi Square test was used to test the relationship between the variables. The P value < 0.05 was considered as statistically significant.

Results : There was no statistically significant association between refractive error and duration of usage on ocular symptoms.

Conclusion: Thus, it was concluded that duration of smartphone usage and refractive error are not responsible for the severity of ocular symptoms according to my study.

KEYWORDS

Smartphone, ocular symptoms, refractive error, computer vision syndrome

Introduction:

Computer and visual display terminals have become an essential part of modern lifestyle.[1]

Computer vision syndrome (CVS) is the complex of eye and vision problems related to near work experience during computer use for two or more hours a day.[2] Nearly 60 million people suffer from CVS globally, resulting in reduced productivity at work and reduced quality of life.[3]

Smartphone use has dramatically increased in recent years. Smartphones may have adverse health effects, particularly on the eyes, because users stare at the screen for a much longer time than they do with ordinary mobile phones.[4] With the increasing prevalence of electronic readers (e-readers) for vocational and professional uses, it is important to discover if there are visual consequences in the use of these products.[5]

A study was done by Kim J et.al. in 715 adolescents from three cities in Korea for the association between exposure to smartphones and ocular health in adolescents. Conclusions were drawn that longer use is associated with high likelihood of having multiple ocular symptoms.[4]

This study is important because of the scarcity of study regarding the use of smartphone and ocular symptoms in India and Asia.

This study is being undertaken to evaluate the ocular symptoms (like eyestrain, headaches, watering of eyes, redness of eyes, itching, burning of eyes, blurred vision, photophobia, dry eyes[2]) on smartphone usage in medical students and to evaluate the impact of refractive errors regarding the same.

This study will help in modifying smartphone usage so the negative impact on ocular health in young adults can be largely prevented.

Objectives of the study:

- To elucidate the ocular symptoms among medical students who use smartphone regularly.
- To evaluate the association of refractive errors to the ocular symptoms in the study group regarding the same.
- To compare the severity of ocular symptoms on smartphone usage in medical students with corrected refractive errors and those with normal vision.

Methodology:

A total of 100 students studying MBBS in Vydehi Institute of Medical Sciences & Research Centre, who use smartphones regularly and those with already corrected or without refractive errors during a period of two months are included in this cross sectional study.

This study requires investigations to be conducted on humans. The ethical clearance for the same has been obtained from Institutional Ethics Committee.

Inclusion criteria:

- Students between 18 and 21 years of age.
- Smartphone users
- Students already corrected of refractive errors.

Exclusion criteria:

- Students suffering from pre-existing infectious conditions of the eye like conjunctivitis, allergic conjunctivitis, scleritis, dry eye, uveitis, glaucoma, stye, blepharitis.
- Students having any fundus pathology like optic atrophy, diabetic retinopathy, hypertensive retinopathy, papilledema.

General Physical Examination is done to exclude students with pre-existing ocular diseases.

Ophthalmology Examination:

- Best corrected visual acuity- Snellen's chart
- Slit lamp evaluation for anterior segment evaluation
- Intraocular Pressure- Goldman's Applanation Tonometry
- Direct and Indirect ophthalmoscopy for posterior segment evaluation
- Tear Breakup Time
- Schirmer's test
- Tear Film Height examination

A self-administered questionnaire is used to collect:

- Socio-demographic data
- History of chronic ocular or systemic diseases
- Daily smartphone usage-
- Short usage (<2 hours/day)
- Intermediate usage (>2 hours/day)
- Excessive but intermittent usage (>2 hours/day and continuous use <=2 hours /occasion)
- Excessive but persistent usage (>2 hours/day and continuous use >2 hours/occasion)
- Symptoms of CVS-irritated or red eyes, burning sensation, excessive tearing, eye pain, headache, itching, blurred vision, double vision
- Refractive errors if any(already corrected)
- Usage of glasses or lens while using smartphone

Data entry and analysis:

Data was entered in MS Excel and analysed using EpiInfo version

7.2.1. Data was summarised and expressed using proportion. Chi Square test was used to test the relationship between the variables. P value < 0.05 was considered as statistically significant.

Sample size: It was estimated by using Single proportion-Absolute precision method. Required sample size is 85 Medical students. It was estimated with 10% precision and at 95% confidence interval. This estimate was obtained by an expected proportion of 0.67 taken from a study done by Ranasinghe P et.al.

Formula used:

$$N=\frac{Z^2(1-\alpha/2)\,P(1-P)}{D^2}$$

Where, P: expected proportion
D: absolute precision
Z(1-α/2): Confidence Interval

Observations and Results:
This questionnaire based study was conducted on 100 medical students of VIMS & RC aged 18-21 years who were smartphone users. After examination they were segregated into study group and control group based on presence of ocular symptoms. The study group includes students with refractive error and normal vision with ocular symptoms (blurred vision, burning sensation, excessive tearing, eye pain, itching, red eyes) and control group was students without ocular symptoms. All the students with refractive errors were myopic and were using power glasses/lens for the same.

This study comprised of 55 females and 45 males. The ocular symptoms presented among medical students in relation to its usage were as follows: Short usage-12(burning sensation-2, excessive tearing-2, itching-2), Intermediate usage-12(blurred vision-1, burning sensation-7, excessive tearing-2, eye pain-4, itching-1, red eyes-5); Excessive but intermittent usage-46(blurred vision-2, burning sensation-7, excessive tearing-7, eye pain-3, itching-3, red eyes-4); Excessive but persistent-13(blurred vision-2, burning sensation-7, excessive tearing-3, eye pain-4, itching-1, red eyes-2)(Table 1). In the study group some students presented with more than one symptom.

Table 1: Distribution of Ocular symptoms and Smartphone usage in medical students

Symptoms	Short Usage (N=12)	Intermediate Usage (N=12)	Excessive Intermittent Usage (N=46)	Excessive Persistent Usage (N=13)
Blurred Vision	0	1	2	2
Burning Sensation	2	7	7	7
Excessive Tearing	2	2	7	3
Eye pain	0	4	3	4
Itching	2	1	3	1
Red eyes	0	5	4	2

The ocular symptoms presented in refractive error and normal vision group was compared(Table 2). Refractive error group presented with the following symptoms: blurred vision-4(absent-54), burning sensation-11(absent-47), excessive tearing-7(absent-51), eye pain-4(absent-54), itching-4(absent-54), red eyes-4(absent-54). Normal vision group presented with the following symptoms: blurred vision-1(absent-41), burning sensation-12(absent-30), excessive tearing-7(absent-35), eye pain-7(absent-35), itching-7(absent-93), red eyes-11(absent-89).

Table 2: Comparison of Refractive Errors and Ocular symptoms

Symptoms		Refractive Error		Total	Chi-square	P-value
		Present	Absent			
Blurred Vision	Yes	4	1	5	1.046	0.3084
	No	54	41	95		
Burning Sensation	Yes	11	12	23	1.269	0.2608
	No	47	30	77		
Excessive tearing	Yes	7	7	14	0.4277	0.5131
	No	51	35	86		
Eye pain	Yes	4	7	11	2.375	0.1233
	No	54	35	89		
Itching	Yes	4	3	7	0.00227	0.9620
	No	54	39	93		
Red Eyes	Yes	4	7	11	2.375	0.1233
	No	54	35	89		

The severity of symptoms (which is taken as the number of symptoms) and duration of smartphone usage among the study groups was tabulated(Table 3). Smartphone usage type and symptoms presented among the students were as follows: (A) refractive error group: short usage-0 symptom(2), 1 or 2 symptoms(4), >2 symptoms(0); intermediate usage-0 symptom(10), 1 or 2 symptoms(6), >2 symptoms(1); excessive but intermittent usage-0 symptom(20), 1 or 2 symptoms(9), >2 symptoms(1); excessive but persistent usage-0 symptom(3), 1 or 2 symptoms(1), >2 symptoms(1), (B) normal vision group: short usage-0 symptom(4), 1 or 2 symptoms(2), >2 symptoms(0); intermediate usage-0 symptom(7), 1 or 2 symptoms(3), >2 symptoms(1); excessive but intermittent usage-0 symptom(9), 1 or 2 symptoms(6), >2 symptoms(1); excessive but persistent usage-0 symptom(1), 1 or 2 symptoms(5), >2 symptoms(2).

Table 3: Comparison showing severity of symptoms and smartphone usage pattern in Refractive error and Normal Vision group

Type of Usage	No. of symptoms	Refractive error		Chi-Square Test	P-Value
		Present	Absent		
Short usage	Nil	2	4	-	-
	One/two	4	2		
	>2	0	0		
Intermediate	Nil	10	7	0.2554	0.8801
	One/two	6	3		
	>2	1	1		
Excessive Intermittent	Nil	20	9	0.5638	0.7544
	One/two	9	6		
	>2	1	1		
Excessive Persistent	Nil	3	1	3.494	0.1743
	One/two	1	5		
	>2	1	2		

Discussion:
The students had atleast one of the symptoms in the symptomatic group and few of them presented with four to five symptoms. None of the students had double vision.

The distribution of ocular symptoms and smartphone usage showed that highest number of symptoms was presented by the excessive but intermittent pattern of smartphone usage. In intermediate and excessive but persistent type the students presented with all the symptoms but in the short usage type only three symptoms were seen(Table 1).

The study groups were analyzed to find if there is an association between refractive error and ocular symptoms. From table 2, it is observed that most of the students did not have ocular symptoms on smartphone usage. Among the students who had ocular symptoms, the commonest symptom was burning sensation(in both-refractive error and normal vision group). Second common symptom was excessive tearing(in both groups). In refractive error group, symptoms such as blurred vision, eye pain, itching and red eyes was seen in 4 students each. In normal vision group symptoms such as excessive tearing, eye pain and red eyes was seen in 7 students each. Also, only one student in the normal vision group had blurred vision. It is observed that normal vision group presented with more symptoms than the refractive error group which shows that refractive error has no significant role in the manifestation of symptoms. On statistical analysis it is found that all the symptoms had a P value>0.05, which is not statistically significant thus showing that there is no correlation between refractive errors and any of the ocular symptoms on smartphone usage. It can be said that corrected refractive error was not responsible for the manifestation of symptoms.

Comparison of severity of symptoms on smartphone usage in students with refractive error and normal vision was done(Table 3). Severity of symptoms was based on the number of symptoms-one being least severe and five being most severe. The students were divided into 3 groups based on the number of symptoms-0 symptoms(nil), 1 or 2 symptoms and >2 symptoms. Excessive but intermittent type of users presented with the

highest number of symptoms. Most of the students either had no symptoms of 1 or 2 symptoms. More than two symptoms was seen in a total of 7 students. Thus we can say that smartphone usage and severity of symptoms were not directly related. Also on statistical analysis it is seen that Chi-Square test was not applicable to short usage pattern and other groups had no significant association. Thus it can be said that there is no association between ocular symptoms and duration of smartphone usage according to this study.

This study provided the information regarding the subject, their smartphone usage and ocular symptoms. But it is important to note that computer vision syndrome is caused by various visual devices (smartphone being one of them). This fact may have influenced the symptoms and their severity. Corrected refractive errors have no bearing on the ocular symptom manifestation or severity according to this study.

Further study can be done regarding this topic by including all visual digital devices or by including only exclusive smartphone users in the study for the evaluation of the hypothesis. Also all the students in the study were myopic and other refractive error groups could not be evaluated. Moreover, only medical students were included. All the other professions involving regular smartphone users should be taken to finalize the association between smartphone usage and eye strain. Larger sample size can be taken to obtain reliable results.

Conclusion:

From this study it can be concluded that there is no significant contribution of refractive error to ocular symptom presentation, that is, students with corrected refractive error did not have more number of symptoms. Also, on prolonged smartphone usage students did not have more number of symptoms. Thus, duration of smartphone usage is not responsible for the severity of ocular symptoms.

This observation is significant as further studies can be done with a similar objective but by taking exclusive smartphone users in the study group or by taking all visual display device users. This study group had only medical students with myopia. Other refractive errors like-hypermetropia, astigmatism, etc. should also be evaluated to support or reject the hypothesis. Also, smartphone users from other professions can be taken to evaluate the hypothesis. Furthermore a larger study group might provide with better data and results.

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