Journal Of Medical Science And Clinical Research
IGM Publication   An Official Publication Of IGM Publication

Prevalence of Dry Eye Disease in Computer Users in Kashmir

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Abstract

Background: *Dry eye disease is a chronic ocular pathology and a major global health problem that manifests with a plethora of symptoms such as burning, photophobia, tearing, and grittiness. Prevalence of dry eye disease ranges from 5% to 35% and is greatly influenced by geographic location and climatic conditions. Computer vision syndrome (CVS) is a leading occupational hazard of 21 century and its symptoms affect nearly about 70% of all computer users. Nearly about 60 million people suffer from CVS with 1 million new cases occurring each year.*

Objective: *To assess the prevalence of dry eye disease in computer users in our population and to study the relationship between computer usage per day and dry eye disease.*

Methods: *Computer users aged between 20-40 years of both genders were included in the study. Subjective assessment for dry eye disease was performed using Ocular surface disease index (OSDI) questionnaire. All the study subjects underwent a detailed routine ophthalmologic examination including, visual acuity, anterior segment and fundus examination with a slit lamp biomicroscope. After routine ophthalmologic examination objective tests, Schirmer's test and TBUT were performed on the subjects.*

Results: *The patients were in the age group of 20-40 years with mean age of 24 years with 276 (58.7%) males and 194 (41.3%) females. Presence of redness, watering of eyes, headache, eye fatigue, pain in and around the eyes, blurred vision was found to be present in 25.5%, 54%, 44.8%, 40.2% and 17.6% respectively. Patients were grouped in groups A, B, C depending on working hours of computer use per day. Group A 2-4 hrs/day, Group B 4-6 hrs/day, Group C 6-8 hrs/day. The objective tests (TBUT and Schirmer's test) were undertaken only in patients with dry eye disease based on OSDI questionnaire. There were 72.1%, 8.3%, 12.1% and 7.4% persons having OSDI score of 0-12, 13-22, 23-32 and $\geq$33 respectively. Mean value of OSDI score was 15.3$\pm$10.08. Prevalence of dry eye disease was found to be 27.9%. Prevalence of dry eye disease was found to be 23.2%, 32.6%, 38.5% and 47.1% in the age group of 20-24 years, 25-29 years, 30-34 years and $\geq$ 35 years respectively. Prevalence of dry eye disease in computer users was found to be 28.3% and 27.3% in males and females respectively. Prevalence of dry eye disease was found to be 11.9%, 26.3% and 48.1% in groups A, B and C respectively.*

Conclusion: *Prevalence of dry eye disease was found to increase with increase in duration of computer use per day. OSDI questionnaire is the best validated questionnaire for diagnosis and grading of DED on basis of symptoms of DED.TBUT measurement is an easy and fast method used to assess the stability of tear film.*

Keywords: *Dry eye disease, photophobia, Computer vision syndrome, Schirmer's test, TBUT.*

Introduction

Dry eye disease is one of the most prevalent ophthalmic conditions seen in clinical practice. Dry eye disease is a chronic ocular pathology and a major global health problem that manifests with a plethora of symptoms such as burning, photophobia, tearing, and grittiness. It has an adverse impact on quality of life[1]. Dry eye is characterized by loss of homeostasis of the tear film accompanied by ocular symptoms in which

tear film instability and hyperosmolarity, ocular surface inflammation, damage and neuro-sensory abnormalities play etiological roles[2]. Prevalence of dry eye disease ranges from 5% to 35% and is greatly influenced by geographic location and climatic conditions[3,4,5]. Computer vision syndrome (CVS) is a leading occupational hazard of 21 century and its symptoms affect nearly about 70% of all computer users[6]. Nearly about 60 million people suffer from CVS with 1 million new cases occurring each year[7].

Computer vision syndrome can occur due to various factors, which are generally classified as personal factors like poor sitting position, improper viewing distances, improper viewing angle, ocular diseases, aging and environment; and computer factors like poor lighting, imbalance of light between the computer screen and the surrounding, poor resolution, poor contrast, glare of the display etc[8]. Working at computer terminals for a long time has been found associated with changes in both relative accommodation and vergences[9]. Computer use for more than 8hrs is a significant risk factor for dry eye disease mainly due to decreased rate in blink rate while using these devices thereby impairing uniform lubrication of tear film over the ocular surface[10]. It has been observed that taking frequent breaks while using computer can increase comfort and relax the accommodative system[11]. Taking a smaller break for (5-10) minutes more frequently has proven beneficial than taking a longer break every (2 or 3) hours[12].

Due to low availability and less utilization of personal protective equipment, accompanied by the high workload and the limited break time while using computer in developing countries, the occurrence of CVS is very high[13].

The questionnaires like OSDI has been devised because the diagnosis and grading of dry eye disease on basis of symptom based questionnaire like the OSDI questionnaire is more reliable than based on clinical tests[14-17]. The OSDI questionnaire can be used easily at work station as it can be safely regarded as a tool for early recognition of dry eye and to seek ophthalmologist help for early diagnosis and intervention. The OSDI is the best validated recent questionnaire, including few questions and more easily applied than most questionnaires. The OSDI is a questionnaire comprising 12 questions, which are subdivided into three groups. The first group contains questions about the ocular symptoms of dry eye disease, the second about the ocular symptoms while watching television or reading a book, and the third group contains the questions about ocular symptoms induced by environmental factors. The OSDI questionnaire is graded on a scale from 0 to 4.[18]

The most common objective tests performed by many ophthalmologists are TBUT and Schirmer's test. These are generally performed after history taking for the diagnosis of DED[19]. The OSDI together with TBUT and Schirmer test can be performed early and used to support diagnosis of dry eye which will help to prevent the loss of work productivity and vision related quality of life in computer users[20].

The tear film breakup time (TBUT) is defined as interval between the last complete blink and appearance of first random dry spot, or disruption in the tear film. TBUT measurement is an easy and fast method used to assess the stability of tear film. It is a standard diagnostic procedure in the dry eye disease. Schirmer's test determines whether the eye produces enough tears to keep it moist. The test works by the principle of capillary action, which allows the water in tears to flow along the length of the paper test strip. The rate of flow along the test strip is proportional to the rate of tear production. Whatman filter paper strip (measuring 5mm x 35mm) is used to measure the amount of tears produced over a period of 5 min. With this background this study was undertaken to evaluate dry eye disease among computer users in our population.[21]

Aims and Objectives

1. Prevalence of dry eye disease in computer users in Kashmiri population.

2. Study the relationship between computer usage per day and dry eye disease.

Material and Methods

It was a population based, cross sectional, observational study conducted in the Department of Ophthalmology, Govt. Medical College, Srinagarover a period of 2 years on computer users aged between 20-40 years of both genders.

Subjective assessment for dry eye disease was performed using Ocular surface disease index (OSDI) questionnaire. Verbal informed consent was obtained before administering OSDI score. Written informed consent was obtained only from persons willing to undergo objective tests. Primary objective of the study was to analyse prevalence of dry eye disease in computer users based on OSDI questionnaire, and to correlate the relationship between computer usage per day and dry eye disease. The OSDI is a questionnaire including 12 questions, which are subdivided into three groups. The first group contains questions about the ocular symptoms of dry eye disease, the second about the ocular symptoms while watching television or reading a book, and the third group contains the questions about ocular symptoms induced by environmental factors. The OSDI questionnaire is graded on a scale from 0 to 4, where 0 indicates none of the time; 1 , some of the time ; 2, half of the time; 3, most of the time and 4 indicates all of the time. The subjects had to assign a score based on duration of symptoms experienced over preceding week. The final score is calculated by multiplying sum of all the scores by 25 and then divided the total number of questions asked. Scores ranged from 0 to 100 with score of 0-12 as normal, 13-22 as mild dry eye, 23-32 as moderate dry eye and 33-100 as severe dry eye.The objective tests were undertaken only in patients with dry eye disease based on OSDI questionnaire who gave the consent for further investigations. These patients had to undergo tear film breakup time and Schirmer's test under similar temperature and humidity conditions. All the study subjects underwent a detailed routine ophthalmologic examination including, visual acuity, anterior segment and fundus examination with a slit lamp biomicroscope. After routine ophthalmologic examination objective tests, Schirmer's test and TBUT were performed on the subjects.

Schirmer's Test - Schirmer's 1 test was performed for all study subjects for evaluation of basal and reflex tear secretion. Whatman filter paper strip (measuring 5mm x 35mm) was used to measure the amount of tears produced over a period of 5 min. The strip was placed in lower fornix at the junction of medial 2/3 and lateral 1/3 of the lower lid margin. The test was performed under ambient light. The subjects were directed to look forward and to blink normally during the course of the test for duration of 5 min. The extent of wetting of strip was measured after 5minutes. The mean Schirmer's test score of both eyes were used for the statistical analysis.

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of Statistical package for social sciences (SPSS). SPSS and Microsoft Excel were used to carry out the statistical analysis of data. Continuous variables were expressed as Mean ±SD and categorical variables were summarized as percentages.Chi-square test was employed for comparison of categorical variables. Analysis of variance (ANOVA) was applied for comparison of various parameters as per computer usage. Graphically the data was presented by bar and pie diagrams. A p value of less than 0.05 was considered statistically significant. All p values were two tailed.

Results

In this cross sectional, observational study we studied 470 patients. The patients were in the age group of 20-40 years with mean age of 24 years. Majority of subjects were in the age group of 20-24 years. The study population consisted of 276 males (58.7%) and 194 females (41.3%). Presence of redness, watering of eyes, headache, eye fatigue, pain in and around the eyes, blurred

vision was found to be present in 25.5%, 54%, 44.8%, 40.2% and 17.6% respectively. Patients were grouped in groups A, B, C depending on working hours of computer use per day. Group A 2-4 hrs/day, Group B 4-6 hrs/day, Group C 6-8 hrs/day. Subjective assessment for dry eye disease was performed using OSDI questionnaire. OSDI questionnaire was administered to all subjects. The objective tests (TBUT and Schirmer's test) were undertaken only in patients with dry eye disease based on OSDI questionnaire. There were 72.1%, 8.3%, 12.1% and 7.4% persons having OSDI score of 0-12, 13-22, 23-32 and ≥33 respectively. Mean value of OSDI score was 15.3±10.08. Prevalence of dry eye disease was found to be 27.9%.

As per OSDI score 8.3%, 12.1% and 7.4% study subjects were having mild (OSDI score=13-22), moderate (23-32) and severe (≥33) dry eye disease respectively. Maximum persons were having moderate dry eye disease. Prevalence of dry eye disease was found to be 23.2%, 32.6%, 38.5% and 47.1% in the age group of 20-24 years, 25-29 years, 30-34 years and ≥ 35 years respectively. Prevalence of dry eye disease in computer users was found to be 28.3% and 27.3% in males and females respectively. Prevalence of dry eye disease was found to increase with increase in duration of computer use per day. Prevalence of dry eye disease was found to be 11.9%, 26.3% and 48.1% in groups A, B and C respectively. According to OSDI questionnaire 8.3%, 12.1% and 7.4% were having mild, moderate and severe dry eye disease respectively. Mean OSDI score was found to be 15.3±10.08. Maximum patients were having moderate dry eye disease. Mean values of Schirmer's test in right eye was found to be 17.26±3.69, 15.20±4.20, 12.81±5.73 and in left eye around 16.96±2.93, 15.93±4.4, 12.53±5.34 in group A, B and C respectively. The mean values of TBUT in right eye were found to be 16.56±4.67, 14.74±5.26 and 13.61±5.78 and in left eye around 16.52±4.70, 14.63±5.35 and 13.06±5.51 respectively.

Table 1

		No. of Study Subjects	Percentage
Age (Years)	20-24	311	66.2
	25-29	86	18.3
	30-34	39	8.3
	≥ 35	34	7.2
	Mean±SD (Range)=24.7±4.35 (20-38)		
Gender	Male	276	58.7
	Female	194	41.3
Symptoms at presentation	Headache	220	46.8
	Dry eyes	153	32.6
	Pain in and around eyes	141	30.0
	Redness	120	25.5
	Blurred Vision	83	17.7
Working hours of computer usage among study subjects	2-4 hours (Group A)	143	30.4
	4-6 hours (Group B)	198	42.1
	6-8 hours (Group C)	129	27.4
	Mean±SD=4.9±2.53		
Distribution of study subjects as per OSDI score	0-12	339	72.1
	13-22	39	8.3
	23-32	57	12.1
	≥ 33	35	7.4
Prevalence of dry eye disease	Present	131	27.9
	Absent	339	72.1
Severity of dry eye disease	Mild (13-22)	39	8.3
	Moderate (23-32)	57	12.1
	Sever (≥ 33)	35	7.4

Table 2: Correlation of Dry eye disease (DED) as per age, gender and computer usage

		DED (n=131)		No DED (n=339)		P-value
		No.	%age	No.	%age	
Age (Years)	20-24	72	23.2	239	76.8	0.005*
	25-29	28	32.6	58	67.4	
	30-34	15	38.5	24	61.5	
	≥ 35	16	47.1	18	52.9	
Gender	Male	78	28.3	198	71.7	0.823
	Female	53	27.3	141	72.7	
Computer usage	Group A(2-4 hours)	17	11.9	126	88.1	<0.001*
	Group B(4-6 hours)	52	26.3	146	73.7	
	Group C(6-8 hours)	62	48.1	67	51.9	

Table 3: Shirmer test and TBUT test values as per computer usage

		Group A 2-4 hours		Group B 4-6 hours		Group C 6-8 hours		P-value
		No.	%age	No.	%age	No.	%age	
Shirmer test values in right eye	< 10	5	4.2	28	14.6	43	32.6	<0.001*
	10-14	26	16.8	43	23.7	37	27	
	15-19	87	57.3	109	54.5	46	37.2	
	≥ 20	25	21.7	18	10.1	3	3.1	
	Mean±SD	17.26±3.69		15.20±4.20		12.81±5.73		
Shirmer test values in left eye	< 10	5	3.5	28	14.1	43	33.3	<0.001*
	10-14	26	18.2	43	21.7	37	28.7	
	15-19	87	60.8	109	55.1	46	35.7	
	≥ 20	25	17.5	18	9.1	3	2.3	
	Mean±SD	16.96±2.93		15.03±4.4		12.53±5.34		
TBUT test values in right eye	< 10	13	9.1	48	24.2	36	27.9	<0.001*
	10-14	17	11.9	39	19.7	32	24.8	
	15-19	72	50.3	76	38.4	42	32.6	
	≥ 20	41	28.7	35	17.7	19	14.7	
	Mean±SD	16.56±4.67		14.74±5.26		13.16±5.78		
TBUT test values in left eye	< 10	14	9.8	51	25.8	38	29.5	<0.001*
	10-14	16	11.2	42	21.2	34	26.4	
	15-19	74	51.7	73	36.9	41	31.8	
	≥ 20	39	27.3	32	16.2	16	12.4	
	Mean±SD	16.52±4.70		14.63±5.35		13.06±5.51		

Discussion

This cross sectional observational study evaluated 470 subjects from both sexes for the prevalence of dry eye disease. The study subjects were in the age group of 20-40 years. There were 311, 86, 39 and 34 persons in the age group of 20-24 years, 25-29 years, 30-34 years and ≥ 35 years respectively. The mean age of our study subjects was 24 years. Similarly in the studies conducted by Reshma BKS et al[22] and Patil SD et al[20] the computer users were in the age group of 20-40 years of age. Our study group consisted of 276 males (58.7%) and 194 females (41.3%) indicating more males than females. Similarly in the studies conducted by Raj A et al[23] (57.14%)

and Pulla A et al[24] majority of the study population were males (56.3%). In our study, presence of headache, dry eyes, pain in and around the eyes, redness, blurred vision were found to be present in 46.8%, 32.5%, 30%, 25.5% and 17.6% respectively. In the study conducted by Pulla A et al[24] the most common symptom was headache (50.4%); followed by eye strain/ eye fatigue (46.7%), pain in and around the eyes (43.3%), dry eyes (35%) and 31.7% of them complained of neck pain and stiffness. In the study conducted by Ranasinghe P et al[25] the most common symptom reported was headache (45.7%), followed by dry eyes (31.1%) and pain in and around the eyes (28.7%). In our study,

30.45%, 42.1%, 27.4% of study subjects were using computer per day for 2-4 hours, 4-6 hours and 6-8 hours respectively. The study subjects were grouped depending on the working hours of computer use per day into Group A (2-4 hours), Group B (4-6 hours) and Group C (6-8 hours).In the study conducted by Reshma BKS et al[23] computer users were grouped in Group A (4-6 hours), Group B (6-8 hours), Group C ($\geq$ 8 hours) according to the exposure to computer per day. There were 20%, 53.33% and 26.66% of study subjects from Group A, B and C respectively.

In our study, there were 72.1%, 8.3%, 12.1% and 7.4% persons having OSDI score of 0-12, 13-22, 23-32 and $\geq$ 33 respectively. Mean value of OSDI score was 15.3$\pm$10.08. In the study conducted by Patil SD et al[20] the mean OSDI scores in computer users were found to be 26.59, 27.99 and 38.86 in group A, B and C respectively. Computer users were grouped in Group A (>2 - $\leq$4 hours), Group B (>4 - $\leq$ 6 hours), Group C (> 6 - $\leq$ 8 hours) according to the exposure to computer per day. The p values of mean OSDI score were found to be significant (p<0.001).In our study, prevalence of dry eye disease was found to be 27.9%. Various studies conducted to estimate prevalence of DED in computer users found prevalence rates of 25% (Patil SD et al[20]), 18.33% (Reshma BKS et al[22]).In our study as per OSDI score 8.3%, 12.1% and 7.4% study subjects were having mild (OSDI score=13-22), moderate (23-32) and severe ($\geq$33) dry eye disease respectively. Majority of subjects were having moderate dry eye disease. In the study conducted by Damle V et al[26] the number of computer users with mild to moderate dry eye disease was found to be 12%, 79% and 84% in groups A, B and C respectively. Computer users were grouped in Group A (0 - $\leq$3 hours), Group B (> 3 - $\leq$ 6 hours), Group C (>6 – 9 hours) according to the exposure to computer per day.

In our study, prevalence of dry eye disease was found to be 23.2%, 32.6%, 38.5% and 47.1% in the age group of 20-24 years, 25-29 years, 30-34 years and $\geq$ 35 years respectively (Table 8). The prevalence of dry eye disease was found to be higher in age groups 30-34 years and $\geq$ 35 years, suggesting that the prevalence of DED increases as the years of computer exposure increases. The p values were found to be statistically significant. In the study conducted by Patil SD et al[20] prevalence of dry eye disease was found to be 13.04% and 51.6% in the age group of 20-30 years and 31-40 years respectively.In our study, prevalence of dry eye disease in computer users was found to be 28.3% and 27.3% in males and females respectively. In the study conducted by Titiyal JS et al[27] the prevalence of dry eye in VDT users among males and females was found to be 65.3% and 34.7% respectively.In our study prevalence of dry eye disease was found to increase with increase in the duration of computer use per day. Prevalence of dry eye disease was found to be 11.9%, 26.3% and 48.1% in groups A, B and C respectively. The p values found were statistically significant (p value <0.05). In the study conducted by Patil SD et al[20] prevalence of dry eye disease in computer users was found to be 9.3%, 18.8% and 45.17% in groups A, B and C respectively and proved statistically significant (p value <0.05). In the study conducted by Reshma BKS et al[22] prevalence of dry eye disease among computer users was found to be 9.09%, 27.27% and 63.63% in groups A, B and C respectively.

In our study, the right eye Schirmer test values of < 10 mm were found to be present in 4.2%, 11.6% and 32.6% persons in group A, B and C respectively. Test values of 10-14mm were found in 16.8%, 23.7% and 27% persons in group A, B and C respectively. Test values of 15-19mm were found in 57.3%, 54.5% and 37.2% persons in groups A, B and C respectively. Test values of $\geq$20 mm were found in 21.7%, 10.1% and 3.1% respectively. Mean values of Schirmer's test in right eye were found to be 17.26$\pm$3.69, 15.20$\pm$4.20, 12.81$\pm$5.73 in groups A, B and C respectively. The left eye schirmer test values of < 10mm were found to be present in 3.5%, 14.1% and 33.3% persons in groups A, B and C respectively. Test values of 10-14mm were found

in 18.25, 21.7% and 28.7% persons in group A, B and C respectively. Test values of 15-19mm were found in 60.8%, 55.1% and 35.7% persons in groups A, B and C respectively. Test values of $\geq$20mm were found in 17.5%, 9.1% and 2.3% persons respectively in groups A,B and C respectively. Mean schirmer test values in the left eye were found to be around 16.96$\pm$2.93, 15.03$\pm$4.4, 12.53$\pm$5.34 in group A, B and C respectively (p value <0.05). In the study conducted by Patil SD et al[20] mean schirmer test values in right eye were found to be around 20.69, 16.9, 12.51 and in left eye around 20. 65, 15.79, 11.6 in groups A, B and C respectively. In the study conducted by Yazici A et al[28] the mean Schirmer test values were found to be 20.6$\pm$12.5. In the study conducted by Raj A et al[23] mean schirmer test value in the computer users was found to be 21.64$\pm$5.67. In our study, the right eye TBUT test values of < 10 sec were found to be present in 9.1%, 24.2% and 27.9% persons in group A, B and C respectively. Test values of 10-14sec were found in 11.9%, 19.7% and 24.8% persons in group A, B and C respectively. Test values of 15-19 sec were found in 50.3%, 38.4% and 32.6% persons in groups A, B and C respectively. Test values of $\geq$20mm were found in 28.7%, 17.7% and 14.7% persons in group A,B and C respectively. The mean values of TBUT in right eye were found to be 16.56$\pm$4.67, 14.74$\pm$5.26 and 13.16$\pm$5.78 in group A, B and C respectively.In our study, the left eye TBUT test values of < 10 sec were found to be present in 9.8%, 25.8% and 29.5% persons in group A, B and C respectively. Test values of 10-14sec were found in 11.2%, 21.2% and 26.4% persons in group A, B and C respectively. Test values of 15-19 sec were found in 51.7%, 36.9% and 31.8% persons in groups A, B and C respectively. Test values of $\geq$20mm were found in 27.3%, 16.2% and 12.4% persons in group A, B and C respectively. Mean TBUT values in left eye were around 16.52$\pm$4.70, 14.63$\pm$5.35 and 13.06$\pm$5.51 in groups A, B and C respectively. The p value was found statistically significant. In the study

conducted by Bhargava R et al[30] mean TBUT was significantly reduced in Computer users (p<0.001). In the study conducted by Raj A et al[23] the mean TBUT value was found to be (10.87$\pm$1.59) in computer (p=0.005). In the study conducted by Patil SD et al[20] the values of mean TBUT in right eye were around 20.56, 16.15, 11.51 and in left eye around 20.25, 16.67, 12.60 in groups A, B, C respectively. The p values of mean values were found to be significant. In the study conducted by Prabhasawat P et al[30] the values of noninvasive TBUT were significantly decreased (p<0.001).

Conclusion

Prevalence of dry eye disease in computer users in Kashmir was found to be 27.9%. Prevalence of dry eye disease was found to increase with increase in duration of computer use per day. Both symptoms and signs of dry eye were found to increase significantly with computer use. Most common symptom found was headache.OSDI questionnaire is the best validated questionnaire for diagnosis and grading of DED on basis of symptoms of DED.TBUT measurement is an easy and fast method used to assess the stability of tear film. It is a standard diagnostic procedure in DED. Schirmer'stest evaluates the total production of tear by the eye. Schirmer's test 1 evaluates basal and reflex tear production. Patient education, deliberate ergonomics of computer use, including screen height, blinking exercises, chair position, glare protection and artificial tear substitutes should be used in order to minimize the symptoms of dry eye syndrome and prevent serious complications.

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