

# Spectrum of Dry Eye Disease in Computer Users of Manipur India

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**Abstract**—Computer and video display users might complain about Asthenopia, burning, dry eyes etc. The management of dry eyes is often not in the lines of severity. Following systematic evaluation and grading, dry eye disease is one condition that can be practiced at all levels of ophthalmic care. In the present study, different spectrum causing dry eye and prevalence of dry eye disease in computer users of Manipur, India are determined with 600 individuals (300 cases and 300 control). Individuals between 15 and 50 years who used computers for more than 3 hrs a day for 1 year or more were included. Tear break up time (TBUT) and Schirmer's test were conducted. It shows that 33 (20.4%) out of 164 males and 47 (30.3%) out of 136 females have dry eye. Possible explanation for the observed result is discussed.

**Keywords**—Asthenopia, computer vision syndrome, dry eyes, Schirmer's test, tear breakup time.

## I. INTRODUCTION

Dry eye disease is a prevalent condition of varying etiologies that affect millions of patients of all ages throughout the world. The prevalence of dry eye is estimated to be from 5 to 34% and dry eye was apparently higher in women than men [1].

Dry eye disease is a disorder of tear film which arises due to tear deficiency or excessive evaporation from the ocular surface which is associated with symptoms of ocular discomfort in the form of asthenopia, burning sensation even diminution of vision [2]. In 2007, the international dry eye workshop (DEW) subcommittee has given revised definition of dry eye disease which states that dry eye disease is a multifactorial disease of the tears and ocular surface that gives asthenopic symptoms and tear film changes in the form of increased osmolality of tear film along with inflammation of ocular surface giving rise to disturbance in visual acuity [3], [4]. Dry eye is recognized as dysfunction of lacrimal functional unit (LFU). LFU is an integral system comprising of ocular surfaces such as conjunctiva, cornea, eyelids, Meibomian and accessory lacrimal glands. Dysfunction of LFU results in unstable tear film and normal function of the eye. In modern society, use of computer is almost universal; therefore, people suffer from computer vision syndrome (CVS) which includes red eye, tired eye blurred vision, diplopia, burning and irritation, dry eye sensation, tearing,

pain in shoulder, pain in neck and back. Among them, the most common symptom is dry eye which arises due to inadequate blinking, excessive evaporation from ocular surface, improper contrast used in display etc. [5], [6]. Normal sight is dependent on a moist ocular surface, which is maintained by a complex interplay of various factors like sufficient quantity of tears, normal composition of tear film, normal lid closure, and regular blinking of lids. The tear film and ocular surface form a stable system which can lose its equilibrium through numerous disturbing factors leading to dry eye. The symptoms of which are dry sensation burning, itching pain, foreign body sensation, photophobia, blurred vision, dry eye produces reflex stimulation of cornea leading to excessive tearing. Dry eye disease in case of computer users depends on lighting, display quality, radiation, refresh rate and positioning of computers [7].

One of the most significant problems in computer display workers is the reduction in blink rate of eye movements. It is shown that individuals blink approximately 66% less when using a computer [8]. This is because the images on video display terminals lacks sharp edges for image formation since it consists of thousands of pixels which collectively form an unresolved image. Hence, the user requires accommodative mechanism to refocus continuously which might result in ciliary muscle fatigue. As a result, blurred or double vision, headache, eye strain and irritated eyes might occur [9]. CVS is a complex syndrome of eye which results from improper use of computer [10]. Manifestation may vary due to several factors including duration of computer usage, sitting posture, viewing distance, type of screen used and level of computer screen. Management of CVS is complexed and can be avoided to some extent by identifying positive factors with special attention to be paid to ergonomic factors like proper placing of computer screen, background lighting, contrast of the computer screen, pixel of the computer, correct posture along with proper working habits.

In a state like Manipur (India), people suffer from dry eye disease, which get increased as a result of computer vision syndrome.

In the present study, investigation on dry eye disease with the patient attending RIMS Hospital, Imphal Manipur (India) based on range of age, sex-wise and occupation.

## II. MATERIALS AND METHODS

A total of 300 patients with age group 15-50 years were selected for study in the Department of Ophthalmology, Regional Institute of Medical Sciences, Imphal Manipur as cases and another 300 cases were selected as control during

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the 2 years period of study from 2014 to 2016. In the study case means patient who uses computer for more than 3 hours a day from last 1 year or more whereas control means a patient who does not use computer. Exclusion criteria for cases include patients with the same age group who use computer for more than 3 hours a day but suffer from ocular infections at the lids, conjunctiva, sclera, uveal tissue and nasolacrimal duct. Any inflammatory condition or other conditions in the eye like foreign body or ocular trauma causing excessive tearing also excluded from the study. Also, patients suffering from any systemic disease are excluded from study. Exclusion criteria for controls include patients attending RIMS hospital with the same age group as cases but using computer for less than 1 year or suffering from any local or systemic disease. After thorough ocular examinations, general physical and systemic examinations, Schirmer test I and tear breakup time were calculated using Schirmer test strip, stop watch, fluorescent strip, bio microscopy [11], [12]. Schirmer test I measures total tear secretions. It is performed with the help of a 5x35 mm strip of Whatmann-41 filter paper which is folded 5 mm from one end and kept in lower fornix at the junction of lateral one third and medial two third [13]. Patient is made to look up and Schirmer test strip is inserted at lower fornix. After 5 minutes wetting of filter paper strip, the necessary measurement is done from the bent end. Normal values of Schirmer test I are more than 15 mm. On the other hand, TBUT is the time duration of developing randomly distributed dry spot over the cornea after having complete blink [14]. An impregnated sodium fluorescent strip moistened with normal saline is instilled into the lower fornix, and the blink is checked. Now eye is examined at slit lamp biomicroscopy in broad beam under cobalt blue filter. After an interval of complete blink, black spot or lines appear in stain film indicating areas of dryness. Its normal value ranges from 15-35 seconds. The amount of Schirmer's test I value in millimeter and TBUT value in seconds were calculated. Further statistical analysis was done using independent t-test and a probability value of less than 0.05 was considered significant.

### III. RESULTS AND OBSERVATION

Table I shows the sex wise distribution of case and control groups of the patients under investigation. It is observed that percentage of male is higher than that of female in both studies i.e. the case group and the control group. The higher percent of male in cases is due to the fact that males are more commonly attached with computer work than females. Similar findings of female preponderance are observed in Uchino M study where the percentage of male suffering from dry eye is 21.5% and female suffering from dry eye is 10.1% [5]. References [5], [12], [15], [16] also observed the high prevalence of dry eye in women than men.

Further, the variation of sex wise distribution with cases and variation of sex wise distribution with dry eye sufferers is undertaken and is shown in Table II. From Table II, it is found that the dry eye percentages of female are higher than that of male.

TABLE I  
SEX-WISE DISTRIBUTION OF CASE AND CONTROL GROUP

Category	Male%	Female%	Total
Cases	164 (54.7%)	136 (45.3%)	300
Controls	167 (55.7%)	133 (44.3%)	300

TABLE II  
SEX-WISE DISTRIBUTION OF CASE AND DRY EYE %

Category	Male (%)	Female (%)
Cases	164 (54.7%)	136 (45.3%)
Dry eye	33 (20.4%)	47 (30.3%)

Fig. 1 shows the variation of case group and control group with age distribution. It is observed that the variation is nearly equal. However, In the study it was observed that the cases and control in different age group gradually increases and found to be maximum at the age group of 41-45 years.

Fig. 2 shows percentage of dry eye sufferer with occupation. It is found that IT workers are the maximum sufferers next is bank workers and then office workers. This is because eye symptoms had a substantially greater correlation with hours of computer used.

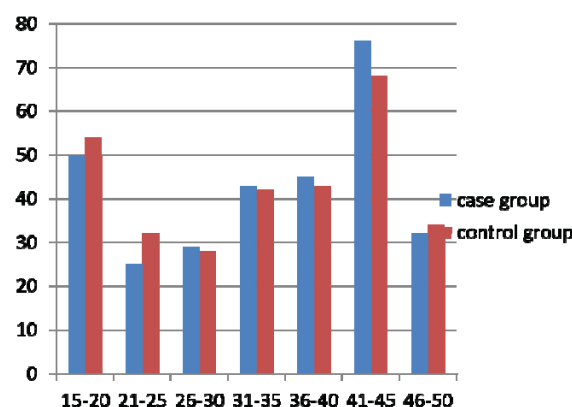


Fig. 1 Age wise distribution among cases and control (x axis age group distribution and y axis percentage of having dry eye)

Hayes et al. [17] suggested that, in cases of computer users, eyes symptom had a substantially greater correlation with physical symptoms. Blurring, dry eye and eye strain were all highly correlated with arches in the back, arms and legs. Although eye symptoms were significantly correlated with the hours of computers use, job demand, other job-related variables and ergonomics, the greatest amount of variance was accounted for by lighting consideration.

TABLE III  
PERCENTAGE OF DRY EYE IN CASE GROUP RELATED TO HOURS OF COMPUTER USED PER DAY

Test	Value	4-5 hours N (%)	6-7 hours N (%)	>7 hours N (%)
Schirmer's test result	0-5mm	0.8(2.7%)	31(10.3%)	45(15.0%)
	6-10mm	32(10.7%)	41(13.7%)	52(17.3%)
	>10mm	56(18.7%)	30(10.0%)	5(1.7%)
TBUT test results	0-4 sec	0.8(2.7%)	32(10.7%)	49(16.3%)
	5-10 sec	36(12.0%)	42(14.0%)	49(16.3%)
	>10sec	52(17.3%)	28(9.3%)	04(1.3%)

Table III shows the percentage of dry eye in relation to hours of computer use. The results were obtained using Schirmer's test result and TBUT test results. In both the test results it was found that percentage of dry eye is higher among the employees who spent more number of hours with computer. This was also reported by other workers [12].

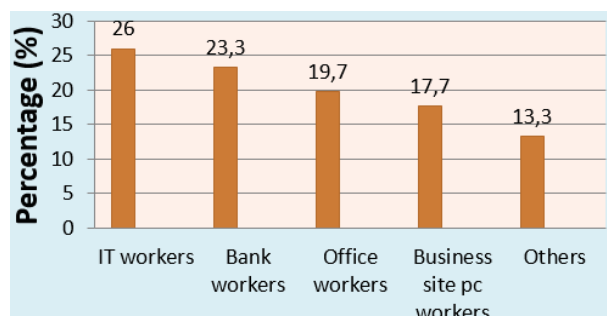


Fig. 2 Occupation wise distribution of dry eye in percentage

Similar results were observed in the present study i.e. longer the duration of using computer higher is the percentage of dry eye. It is observed that the percentage of severe dry eye is found to increase from 2.7%, 10.3%, 15% as computer using hours increases from 4-5 hours/day, 6-7 hours/day and >7 hours/day respectively. This result is obtained using Schirmer's test. Using TBUT test the results obtained are 12%, 10.7% and 16.3% as computer using hours increases from 4-5 hours/day, 6-7 hours/day and >7 hours/day respectively. Moderate dry eye is found to be 10.7%, 13.7%, 17.3% and 12%, 14%, 16.3% from Schirmer's test and TBUT test respectively. Similar study is done by Akinbinu et al. [18] and it was found that dry eye is more common among employees who spent 6-8 hours on the computer daily (48.9%) as compared to 23.7% and 0.72% among those who spent 3-4 hours and 1-2 hours respectively. Uchino et al. [5] found that <2 hours computer users gives result for dry eye as 31.6%, 2-4 hours users gives result 35.2% and >4 hours gives 41.1%. Hence, it is learnt that as the duration of computer usage increases, percentage of dry eye also increases. Table IV shows the percentage of dry eye in cases group related to years of using computer. Schirmer's test result shows that severe dry eye is 1.7%, 12.3%, 14.0% i.e. it increases as the duration of computer usage increased in the range of 2-3 years, 4-5 years and >6 years respectively and TBUT test shows 1.7%, 13.3%, 14.7% with increased usage of years. Moderate dry eye is found to be 13.0%, 14.3%, 14.3% and 14.0%, 13.7%, 14.7% respectively from Schirmer's test and TBUT test result. Akinbinu et al. [18] found that dry eye sufferer is only 6% who use computer for less than 1 year, 15% who use between 1 and 2 years and 28% for duration of 3 to 5 years. About 29% and 20% have been using computer for 6-8 years and more than 8 years respectively.

Table V shows the Shirmer's test results and TBUT test results among case groups and control groups. Shirmer's test shows that the severe dry eye occurrence is 29.7% and 11.7% in cases and control group respectively while moderate dry eye occurrence is 42.3% and 20.7%. TBUT test results show

that severe dry eye occurrence is 28.0% and 12.3% in cases and control respectively while moderate dry eye occurrence is 41.7% and 20.3%.

TABLE IV  
PERCENTAGE OF DRY EYE IN CASE GROUP RELATED TO YEARS OF USING COMPUTER

Test	Value	2-3 years (%)	4-5 years N (%)	>5 years N (%)
Schirmer's test result	0-5mm	05(1.7%)	37(12.3%)	42(14.0%)
	6-10mm	39(13.0%)	43(14.3%)	43(14.3%)
	>10mm	32(10.7%)	31(10.0%)	29(9.7%)
TBUT test result	0-4 sec	05(1.7%)	40(13.3%)	44(14.7%)
	5-10 sec	42(13.7%)	42(14.0%)	44(14.7%)
	> 10sec	29(9.7%)	29(9.7%)	26(8.7%)

TABLE V  
COMPARISON OF SCHIRMER'S TEST AND TBUT TEST RESULTS AMONG CASE GROUP AND CONTROL GROUP

Test	Value	Case group N (%)	Control group N (%)	P value
Schirmer's test result	0-5mm	89(29.7%)	35(11.7%)	0.001
	6-10mm	127(42.3%)	62(20.7%)	
	>10mm	84(28.0%)	203(67.7%)	
TBUT test result	0-4 sec	84(28.0%)	37(12.3%)	0.001
	5-10 sec	125(41.7%)	61(20.3%)	
	> 10sec	91(30.3%)	202(67.3%)	

In both tests, p value is 0.001 which is statistically highly significant. This signifies that the quantitative tear formation is significantly lower in the cases as compared to the controls group.

#### IV. CONCLUSION

Dry eye disease is more prevalent among female workers than male among the computer users. The present study represents the largest epidemiologic data from Manipur describing the prevalence of dry eye syndrome in computer users. Percentage of dry eye increases with advancing of age, longer duration of computer exposure. From the present study, using Schirmer's test and TBUT test results dry eye occurs more in case group. Also, the prevalence of dry eye increases with increasing duration of computer used. Computer and video display terminal usage have caused major changes in habitual manners of millions of people. Although using computer does not cause unique organic ocular disease by itself, users complaints of asthenopic symptom burning sensation and dry eye. Dry eye a result of computer vision syndrome can be minimized with certain modification in usage like taking frequent break after every used, frequent blinking in between, using proper lighting, minimizing the glare, adjusting display setting size, contrast brightness etc., using antiglare lens if possible.

#### REFERENCES

- [1] Chaudhury Z, Vanathi M. Post graduate Ophthalmology. Jaypee medical publishers, 2012.
- [2] Samar Kumar Basak. *Dry Eye Disease*. All India Ophthalmological Society. 2013.
- [3] Kallarackal GU, Ansari EA, Amos N, et al. A comparative study to assess the clinical use of fluorescein meniscus time (FMT) with tear break up time (TBUT) and Schirmer's tests (ST) in the diagnosis of dry eyes. *Eye* 2002; 16:594-600.

- [4] Craig JP, Singh I, Tomlinson A et al. The role of tear physiology in ocular surface temperature. *Eye* 2000; 14 (Pt 4): 635-41.
- [5] Uchino M, Debra A, Schiumberg M, Dogru Y, Uchino K, Takebayashi K, Tsubota. Prevalence of dry eye disease among Japanese visual display terminal users. *American Academy of Ophthalmology*. 2008; 115:1982-88.
- [6] Kanski JJ, “*Clinical Ophthalmology*” Elsevier Butterworth-Heinemann, 2007.
- [7] Wimalasundera S. Computer vision syndrome. *Galle Medical Journal*, 2006; 11(1):25-29.
- [8] Blehm C, Vishnu S, Khattak A, Mitra S, Yee R. Computer vision syndrome. A review on survey of Ophthalmology. 2005; 50(3): 253-262.
- [9] Yanoff M. *Ophthalmic diagnosis and treatment*, Jaypee publication, 2014.
- [10] Barar A, Apatachioaie ID, Apatachioaie C, Marceanu-Brasov L. *Oftalmologia*. 2007; 51(3):104-9. (Ophthalmologist and "computer vision syndrome"). (Article in Romanian). PMID:18064965.
- [11] Khurana AK, *Comprehensive Ophthalmology*. New Age International, 2007.
- [12] Xu L, You QS, Wang YX, Jonas JB. Association between gender, ocular parameters and diseases: The Beijing eye study. 2010.
- [13] Jayant Kadaskar, Md. Shahid Alam, Bipasha Mukharjee. Online Textbook of Ophthalmology. [www.eophtha.com/eophtha/OTO/Oculoplasty/Lacrimal.html](http://www.eophtha.com/eophtha/OTO/Oculoplasty/Lacrimal.html)
- [14] KN Jha. Tear Break-up Time in High Altitude Areas. *Medical Journal Armed forces India*. 2009; 65: 2-3.
- [15] Schaumberg DA, Sullivan DA, Buring JE, Dana MR, “Prevalence of dry eye syndrome among US women” in *American journal of ophthalmology*, vol.136, 2003, 318-321.
- [16] Gayton J. Etiology, prevalence and treatment of dry eye disease” in *Clinical ophthalmology*, vol. 3, 2009, 405-12.
- [17] Hayes JR, Sheedy JE, Stelmack JA and Heaney CA. Computer use, symptoms and quality of life. *Optometry and Vision Sciences*; 2007; 84(8):739-45.
- [18] Akinbinu TR, Mashalla YJ. Knowledge of computer vision syndrome among computer users in the workplace of Abuja. *Nigeria academic Journals* 2013; 4(4):58-63.